THE WALSH-SUZZALLO
ARITHMETICS

ESSENTIALS

TABLES

LINEAR MEASURE

12	inches (in.)	= 1 foot.	**ft.**
3	feet.	= 1 yard	**yd.**
5¼	yards, or 16½ feet	= 1 rod	**rd.**
40	rods	= 1 furlong	**fur.**
320	rods	= 1 mile	**mi.**

1 mi. = 320 rd. = 1760 yd. = 5280 ft. = 63,360 in.

A *hand*, used in measuring the height of horses, = 4 in. A *knot*, used in measuring distances at sea, = 1.15 mi. A *fathom*, used in measuring the depth of the sea, = 6 ft.

SQUARE MEASURE

144	square inches (sq. in.) .	= 1 square foot . . .	sq. ft.
9	square feet	= 1 square yard . . .	sq. yd.
30¼	sq. yd., or 272¼ sq. ft. .	= 1 square rod . . .	sq. rd.
160	square rods	= 1 acre	A.
640	acres	= 1 square mile . . .	sq. mi.

1 A. = 160 sq. rd. = 4840 sq. yd. = 43,560 sq. ft.

A Section of land is a square mile.

Roofing, flooring, and slating are often estimated by the *square*, which contains 100 square feet.

SURVEYORS' MEASURE

In measuring land, surveyors use a chain (ch.) which contains 100 links (l.) and is 4 rods long. Since the chain is 4 rods long, a square chain contains 16 sq. rd., and 10 sq. ch. = 160 sq. rd., or 1 acre.

CUBIC MEASURE

1728	cubic inches (cu. in.) .	= 1 cubic foot . . .	cu. ft.
27	cubic feet	= 1 cubic yard . . .	cu. yd.
128	cubic feet.	= 1 cord	cd.
16	cubic feet	= 1 cord ft.	cd. ft.
8	cord feet	= 1 cord	cd.

NOTE. — In computing the contents of an enclosing wall, masons and brick-layers regard it as one straight wall whose length is the distance around it on the outside. Corners are thus measured twice.

A *perch* of stone or masonry is 16½ ft. long, 1½ ft. thick, and 1 ft. high, and contains 24¾ cu. ft.

MEASURES OF CAPACITY

LIQUID MEASURE		DRY MEASURE	
4 gills = 1 pint . . . . pt.		2 pints = 1 quart . . qt.	
2 pints = 1 quart . . . qt.		8 quarts = 1 peck . . pk.	
4 quarts = 1 gallon . . gal.		4 pecks = 1 bushel . . bu.	

The *standard gallon* contains 231 cubic inches.
The *standard bushel* contains 2150.42 cubic inches.

The capacity of cisterns, reservoirs, etc., is often expressed in barrels (bbl.) of 31½ gallons each, or in hogsheads (hhd.) of 63 gallons each. In commerce, these vary in size.

AVOIRDUPOIS WEIGHT

16 ounces (oz.) . . . = 1 pound	lb.
100 pounds . . . . . = 1 hundredweight. .	cwt.
2000 pounds . . . . . = 1 ton	T.

One pound Avoirdupois = 7000 grains.

The *long ton* of 2240 pounds is used in the United States Custom Houses and in weighing coal and iron at the mines.

STANDARD WEIGHTS

1 bushel of wheat . . . = 60 lb.		1 bushel of potatoes. . = 60 lb.	
1 bushel of corn . .. . = 56 lb.		1 barrel of flour . . . = 196 lb.	
1 bushel of oats . . . = 32 lb.		1 barrel of pork . . . = 200 lb.	
1 bushel of barley. . . = 48 lb.		1 keg of nails . . . . = 100 lb.	

TROY WEIGHT

24 grains (gr.) . . . . = 1 pennyweight . .	pwt.
20 pennyweights . . . . = 1 ounce	oz.
12 ounces . . . . . . = 1 pound	lb.

One pound Troy = 5760 grains.

APOTHECARIES' WEIGHT

60 grains (gr.) . . . .. = 1 dram . . .	dr., or ʒ.
8 drams . . . . . . = 1 ounce . . .	oz., or ℥.
12 ounces . . . . . . = 1 pound . . .	lb., or ℔.

One pound Apothecaries' weight = 5760 grains.

BRITISH OR STERLING MONEY

4 farthings . . . . . = 1 penny	d.
12 pence. . . . . . . = 1 shilling	s.
20 shillings . . . . . = 1 pound	£.
5 shillings . . . . . = 1 crown.	

The value of £1 is $4.8665 in United States gold coin.

The unit of French money is 1 franc, which is 19.3 cents. The unit of German money is 1 mark, which is 23.8 cents.

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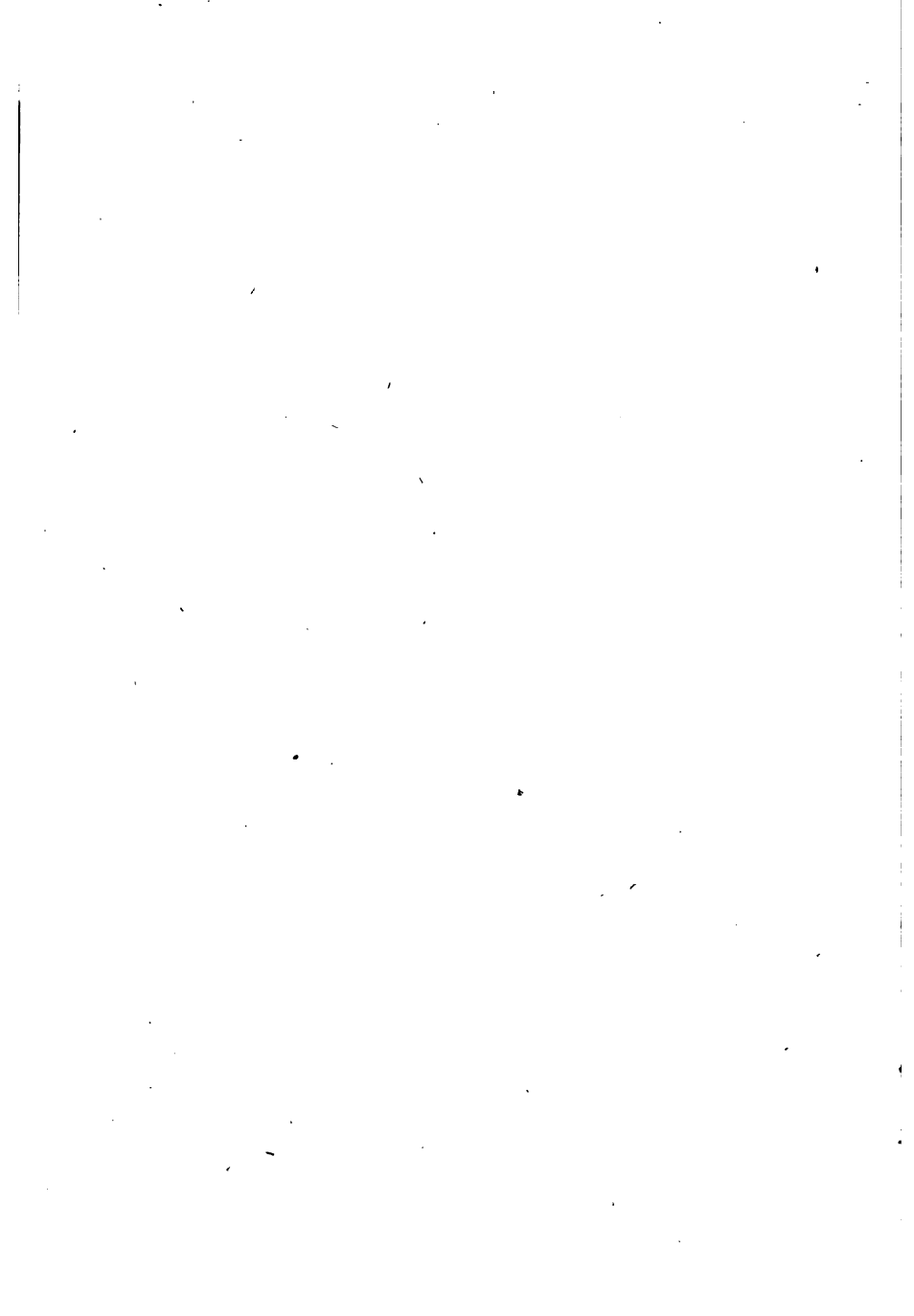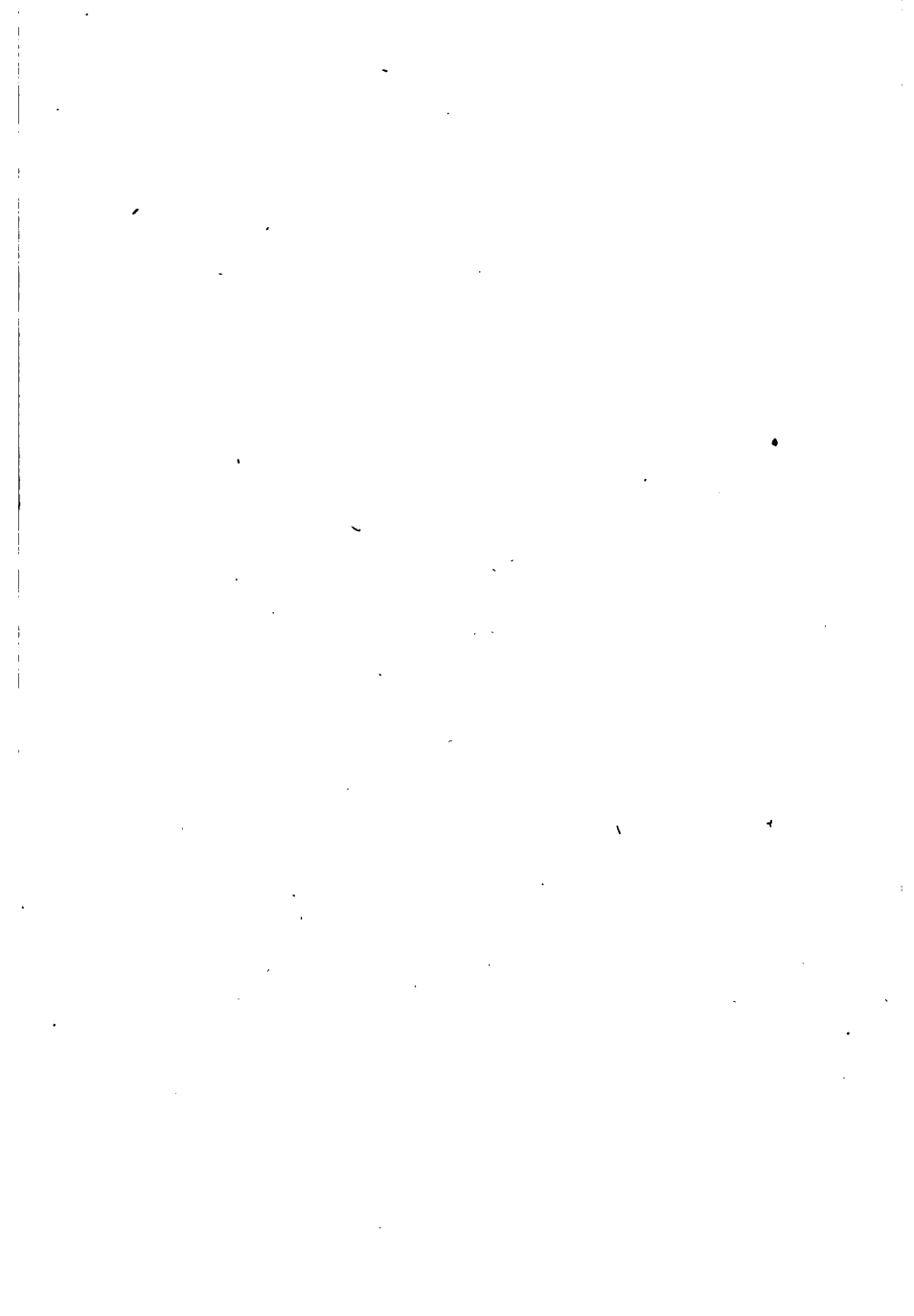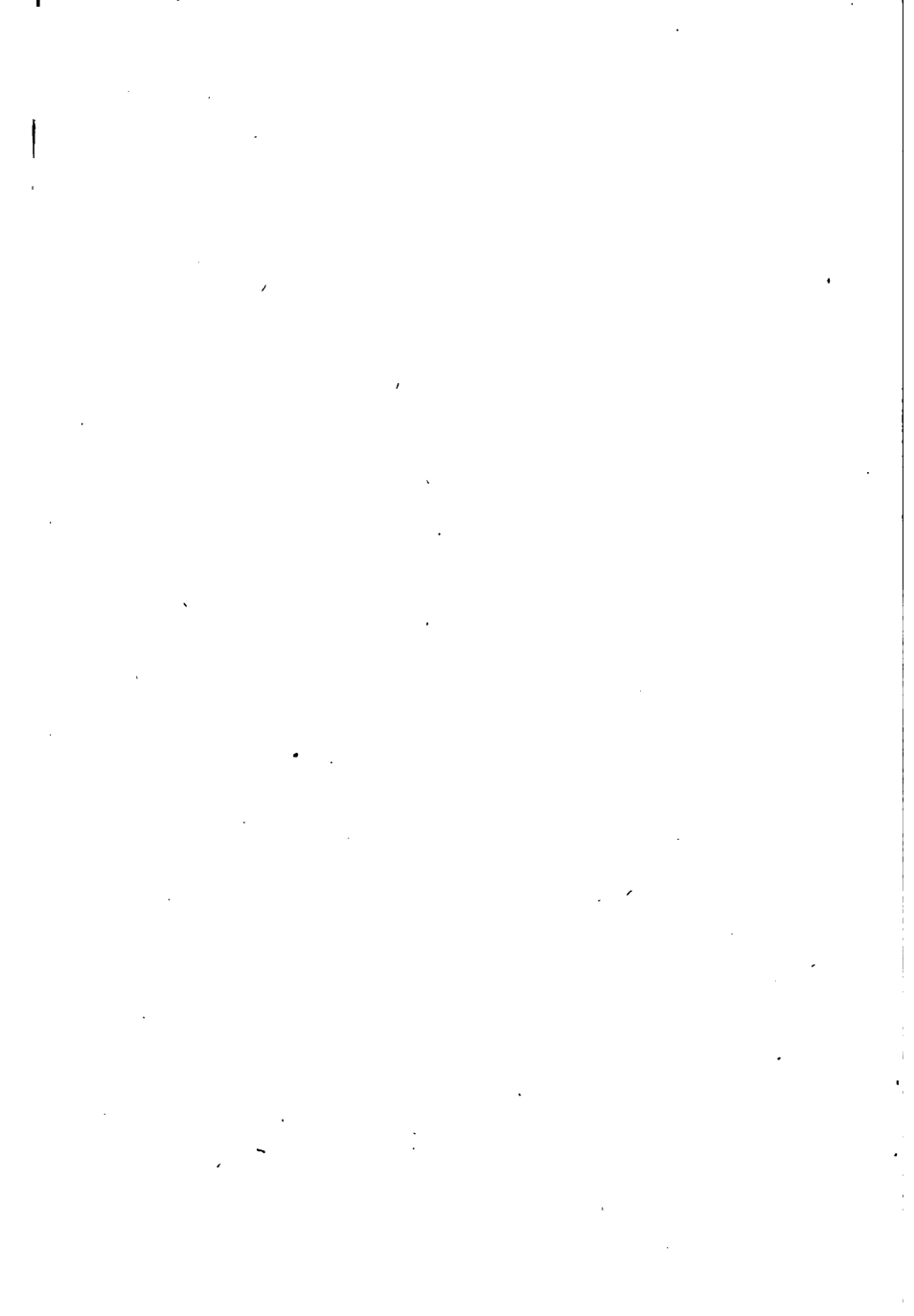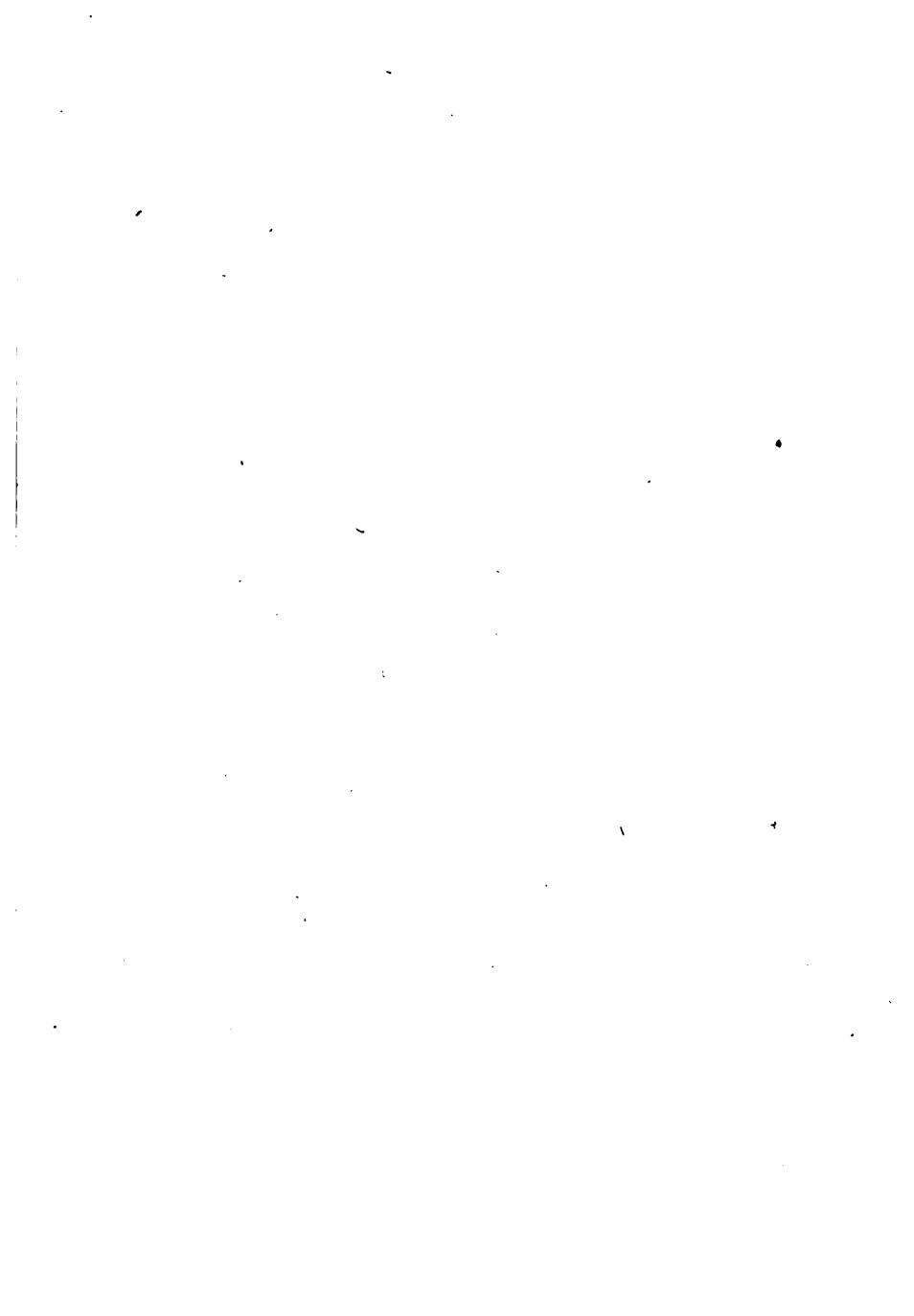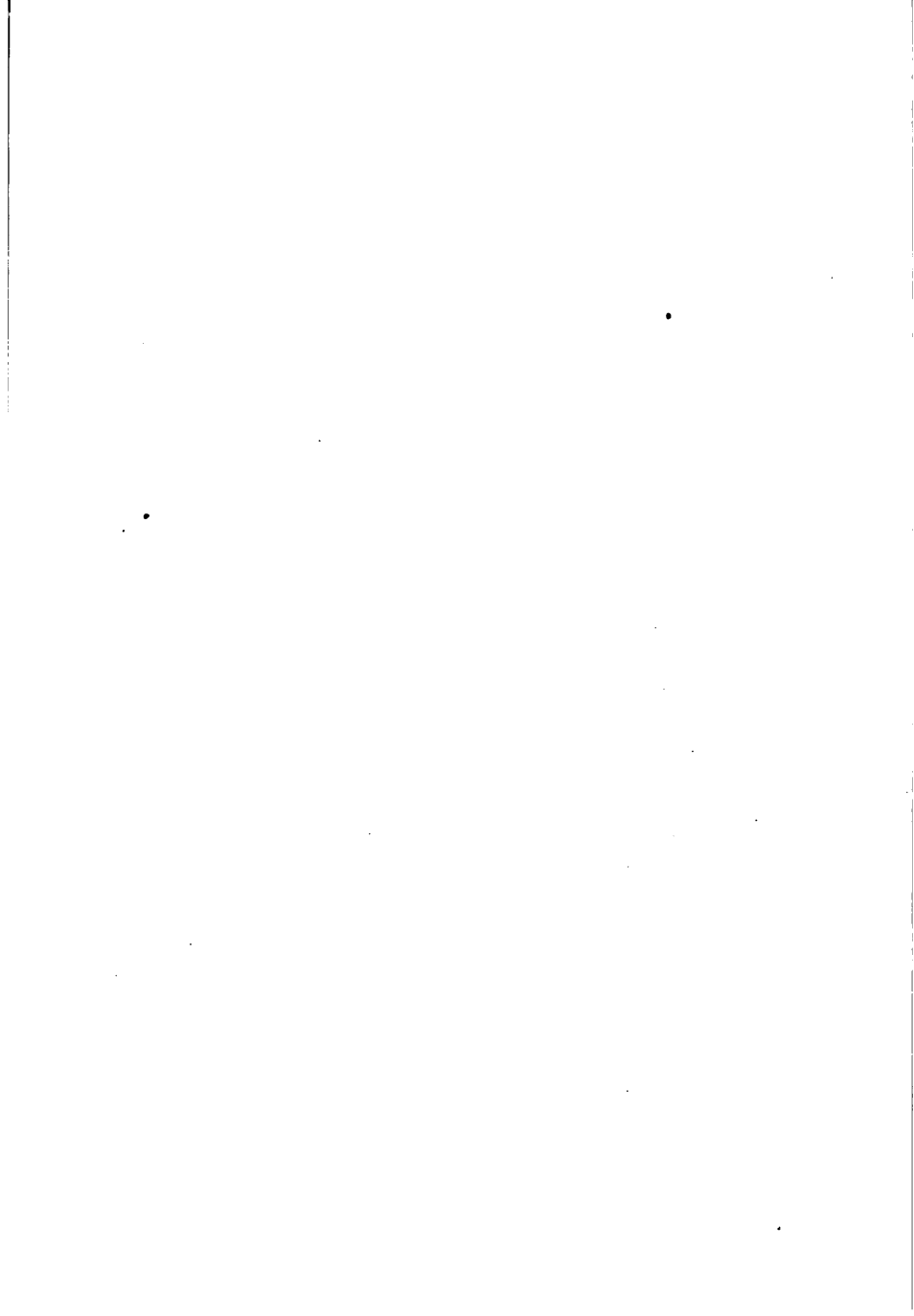
WALSH-SUZZALLO
ARITHMETICS

BOOK TWO
ESSENTIALS

BY

JOHN H. WALSH

ASSOCIATE SUPERINTENDENT OF SCHOOLS
THE CITY OF NEW YORK

AND

HENRY SUZZALLO

PROFESSOR OF THE PHILOSOPHY OF EDUCATION
TEACHERS COLLEGE, COLUMBIA UNIVERSITY

THE WALSH-SUZZALLO ARITHMETICS

Three=Book Course

I. **FUNDAMENTAL PROCESSES.** 256 pages.
II. **ESSENTIALS.** 298 pages.
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I. **FUNDAMENTAL PROCESSES.** 256 pages.
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D. C. HEATH & CO.; PUBLISHERS

PREFACE

THESE books will develop all the mathematical power
needed by the average person in the accurate control of
his affairs. They cover all the problems and computa-
tions most likely to occur in the course of practical life.
From the first to the eighth year, the purpose has been to
teach first the most important topics of arithmetic and
last those least frequently used. Actual surveys into the
current uses of various arithmetical topics have been the
basis for the arrangements given in these volumes. In
consequence, the teacher may feel that the child, who is
leaving school at the end of any particular grade, has been
taught whatever would be most useful to him, considering
that his schooling had to stop just then. Nothing in the
next grade beyond is more important than what he has
just studied.

Furthermore, these volumes have taken into account
social considerations as well as the current utility of
mathematical facts and processes. They have taken into
account the most important social fact connected with school
attendance, namely, that the great majority of school
children never go beyond the sixth school grade. In con-
sequence these books are so constructed as to complete
the fundamental processes of arithmetic by the end of the

sixth year of school life. No pupil studying from this
course through the first six years will be left without an
essential mathematical power. With this foundation, he
can proceed by himself, as need confronts him, to learn
shorter or more convenient methods of calculation and to
make new applications of the processes learned.

In the construction of a thorough six-year course in the
fundamentals of arithmetic, it has been necessary to elim-
inate whatever is unimportant. The authors have not hesi-
tated to delay short methods of calculation until the end
of the sixth year. To arrange for one fundamental method
of calculation in each field of arithmetic, which will give
power over all cases, is a saner procedure than to add
special short methods which will crowd out fundamental
methods in other fields. When the child has one way of
meeting every possible case in arithmetic, it is then time
enough to shorten his methods of operation by special
additional techniques. It would be an obvious mistake to
teach a child two methods of long division in one grade
when that meant excluding from the child's equipment a
fundamental way of dividing decimals. This and similar
mistakes occur constantly with children leaving school at
the end of the sixth year. Part of the fundamentals of
arithmetic are taken up in grades they never enter.
Something less important left out below would have avoided
this error of judgment in arranging the course of study.

Furthermore, it may be said that in attaining a higher
social utility in the arrangement of these books, nothing
of teaching efficiency has been sacrificed. In completing

the fundamentals in six school years, nothing radical or experimental has been done! Every topic in arithmetic which these books require to be taught at a particular time in the fourth, fifth, or sixth year is now already successfully taught at that period in some progressive school or school system. The authors have merely combined the successful practices of many efficient schools into a unified scheme of procedure, now urgently demanded by all who understand the needs of those who cannot remain in school eight years.

In addition to giving the child all the fundamental skills of calculation, room has been found for the introduction of those simple institutional applications which are likely to be among the immediate needs of those who leave school early. Every child who completes the sixth grade will know something of being accurate and business-like about his own earning, spending, and saving. He will comprehend the simplest methods of accounting which are to aid him in his own modest affairs, whether these relate to the industrial payroll, the farm income, the household expenditure, or the savings in the bank. Thus every real economy in the teaching of arithmetic has enhanced efficiency.

This volume, the second of the three-book series, completes those fundamental knowledges of arithmetic without which no man can really be competent. The first and preceding volume laid a basis for the work which this volume completes. The two volumes together give a thorough command over all the essentials of arithmetic. The third volume, which succeeds and supplements the first two, is

an extension of arithmetical knowledge specially devised for those who continue school beyond the sixth grade. While it aims to increase mechanical efficiency by further drill in processes, and by the addition of specialized and shorter methods of calculation, its chief purpose is to give an understanding of business practice in industrial, agricultural, commercial, and domestic life, so that the pupil is made more accurate and resourceful in applying arithmetical methods to the real problems of human affairs.

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SECTION ONE — INTRODUCTORY REVIEW

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ARITHMETIC

SECOND BOOK

SECTION I

INTRODUCTORY REVIEW

Oral Counting Drills

1. Counting by 7's.

    a. Beginning with 7, count by 7's to 98.

    b. Beginning with 6, count by 7's to 97.

    c. Beginning with 8, count by 7's to 99.

    d. Beginning with 9, count by 7's to 93.

2. Counting by 8's.

    a. Beginning with 8, count by 8's to 96.

    b. Beginning with 7, count by 8's to 95.

    c. Beginning with 9, count by 8's to 97.

    d. Beginning with 6, count by 8's to 94.

3. Counting by 9's.

    a. Beginning with 9, count by 9's to 99.

    b. Beginning with 8, count by 9's to 98.

    c. Beginning with 7, count by 9's to 97.

    d. Beginning with 6, count by 9's to 96.

NOTE. — A minute or two should be given daily to these drills. The teacher says, "Count by 7's; beginning with 7." Successive pupils say, "14, 21, 28," etc., until 98 is reached. Then the teacher says, "Begin with 6," and successive pupils say, "13, 20, 27," etc., until 97 is reached.

Addition Drills

1. Add 8 to each of the following: *a.* 16. *b.* 24. *c.* 38. *d.* 49. *e.* 55. *f.* 67. *g.* 78. *h.* 83.

2. Add 9 to each of the following: *a.* 81. *b.* 75. *c.* 64. *d.* 58. *e.* 42. *f.* 37. *g.* 26. *h.* 13.

3. Add 7 to each of the following: *a.* 15. *b.* 28. *c.* 34. *d.* 47. *e.* 59. *f.* 66. *g.* 73. *h.* 88.

4. Add 6 to each of the following: *a.* 84. *b.* 79. *c.* 67. *d.* 56. *e.* 48. *f.* 37. *g.* 28. *h.* 15.

5. Add 5 to each of the following: *a.* 16. *b.* 28. *c.* 39. *d.* 46. *e.* 58. *f.* 67. *g.* 79. *h.* 87.

Graded Sight Drills

Addition and Subtraction

1. Give sums:

a. $14+9$ *b.* $9+67$ *c.* $86+9$ *d.* $9+34$ *e.* $88+9$
f. $23+8$ *g.* $8+54$ *h.* $75+5$ *i.* $8+48$ *j.* $77+4$
k. $35+7$ *l.* $7+49$ *m.* $69+6$ *n.* $7+57$ *o.* $69+8$

2. Give remainders:

a. $23-5$ *b.* $24-15$ *c.* $91-9$ *d.* $92-87$ *e.* $30-9$
f. $31-6$ *g.* $32-26$ *h.* $83-8$ *i.* $84-76$ *j.* $40-7$
k. $42-7$ *l.* $43-37$ *m.* $76-7$ *n.* $73-69$ *o.* $50-5$

3. Add:

NOTE. — To add 33 and 45, think 73 (33 + 40), 78 (adding 5).
To add 26 and 68, think 86 (26 + 60), 94 (adding 8).

a. $30+40$ *b.* $32+40$ *c.* $33+41$ *d.* $33+48$
e. $20+50$ *f.* $20+55$ *g.* $22+55$ *h.* $22+59$
i. $60+30$ *j.* $63+30$ *k.* $63+36$ *l.* $37+36$
m. $40+40$ *n.* $40+44$ *o.* $41+44$ *p.* $48+44$

Sight Problems

1. A boy purchases 60 cents' worth of groceries. How much change should he receive out of 75 cents?

2. There are 25 boys and 30 girls in a class. How many pupils are there in the class?

3. How many minutes are there from 20 minutes before nine to 15 minutes after nine?

4. How many days are there from December 11 to December 25?

5. After selling 48 tons of hay, a farmer still has 15 tons. How many tons had he at first?

6. How many acres are there in two fields, one containing 35 acres, and the other containing 40 acres?

7. After traveling 75 miles, how far must I go to complete a trip of 95 miles?

8. Mary worked 20 examples on Monday and 19 on Tuesday. How many did she work in the two days?

9. How many blocks does a boy walk in going to school and returning if he walks 15 blocks each way?

10. How many pupils are present of a class of 40, when 12 are absent on account of a storm?

11. What is the cost of two cows at $45 each?

12. A girl is saving her money to buy a 50-cent doll. When she has 38 cents, how much does she still need?

13. There are 29 grown people in a car and 12 children. How many passengers are there in the car?

14. A 40-quart can contains 27 quarts of milk. How many more quarts will it hold?

15. A boy has 60 examples to work in a week. How many has he still to do when he has done 45?

Adding Whole Numbers

Written Exercises

1. A freight train carried 387 pounds of clover seed, 4095 pounds of timothy, 57,367 pounds of wheat, 825,456 pounds of corn, 6789 pounds of flaxseed, 32,506 pounds of oats, and 9987 pounds of barley. What was the total weight of the seeds?

```
     387 lb.                    PROCESS
   4,095              Write lb. (the abbreviation for pounds) after the
  57,367          first addend.  Add upwards, beginning with the
 825,456          ones' column: 13, 22, 28, 35, 40, 47; write 7.  Carry
   6,789          4 to the second column, and think 12 (skip 0), 20,
  32,506          25, 31, 40, 48; write 8.  Carry 4 to the third column,
   9,987          and think 13, 18, 25, 29, 32 (skip 0), 35; write 5.
 936,587 lb.      Carry 3 to the fourth column, and think 12, 14, 20,
                  25, 32, 36; write 6.  Carry 3 to the fifth column,
                  and think 6, 8, 13; write 3.  Carry one to the sixth
column, and think 9; write 9.  Place lb. after the sum.
```

TEST

Cover the answer with a piece of paper. Upon this write the new results. Add downward.

b.	c.	d.	e.
52,363	29,438	48,375	64,235
9,888	4,567	57,842	96,487
65,435	887	9,384	8,986
82,389	37,469	77,485	678
654	18,253	4,969	56,787
9,839	3,579	53,774	959
27,596			

2. Find sums:

a. 46 lb. + 135 lb. + 72 lb. + 39 lb. + 427 lb. + 64 lb. + 139 lb.

Adding Dollars and Cents

3. During March Mr. X bought goods costing $18.75, $4.48, $32, $6.93, and $.86.

$18.75	
4.48	**PROCESS**
32.—	Write the successive addends under each other, keeping the decimal points in the same vertical line. Use the dollar sign with only the first addend and the sum.
6.93	
.86	
$63.02 *Ans.*	

4. Add the following :

a. $596.80, $64.35, $806, $284.35, $9718.87, $.68, and $4772.13.

b. $76.71, $328.57, $.08, $4156.12, $13,389.28, $4.34, and $667.94.

c. $781.74, $97.66, $489, $82.98, $.33, $121.65, and $148.

d. $857.23, $17.67, $312.77, $886, $78.81, $.09, $.36, and $95.34.

e. $596.80, $80.62, $718.87, $4772.13, $947.82, $684, $135.79, $.25, and $83.06.

f.	52,363	*g.*	29,438	*h.*	48,375	*i.*	64,235
	9,888		4,567		57,482		96,487
	65,435		887		9,384		8,986
	82,389		37,469		77,485		678
	654		18,253		4,969		56,787
	9,839		3,579		53,774		959
	27,506		24,608		879		3,465

Subtracting Whole Numbers

Written Exercises

1. A man's earnings in a year were $6400. He saved $497.59. How much did he pay out during the year?

PROCESS

Minuend $6400.

Subtrahend 497.59

Remainder $5902.41 *Ans.*

Omit the dollar mark from the subtrahend. Think 9 and **1** (writing 1) are 10. Carrying 1 to 5, think 6 and **4** (writing 4) are 10. Carrying 1 to 7, think 8 and **2** (writing 2) are 10. Carrying 1 to 9, think 10 and **0** (writing 0) are 10. Carrying 1 to 4, think 5 and **9** (writing 9) are 14. Carrying 1, think 1 and **5** (writing 5) are 6.

TEST

Cover the minuend with a piece of paper. On it write the sum of the remainder and the subtrahend, adding upwards. Remove the paper and compare the sum with the minuend.

NOTE. — In working an example, do not write the words "minuend," "subtrahend," etc.

---

2. Find remainders :

a. 16346 − 8974   *b.* $4000 − $138.06

c. 18075 − 9889   *d.* $240.35 − $6.97

e. 79000 − 58960   *f.* $217.40 − $108.16

g. 30000 − 16432   *h.* $123.45 − $98.76

Sight Exercises

1. Subtract :

a. 140 − 60   *b.* 260 − 70   *c.* 1200 − 500

d. 243 − 60   *e.* 363 − 70   *f.* 1220 − 600

g. 345 − 65   *h.* 466 − 76   *i.* 1280 − 780

j. 445 − 62   *k.* 566 − 75   *l.* 1290 − 820

m. 440 − 62   *n.* 560 − 75   *o.* 1200 − 820

Addition and Subtraction Combined

Written Exercises

1. A farmer raised 1800 bushels of wheat. How many bushels had he left after selling 347 bushels, 86 bushels, 443 bushels, and 79 bushels?

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PROCESS

1800 bu.
347
86
443
79

Ans. 845 bu.

Add the ones' column of the four subtrahends; 12, 18, 25 and think **5** (writing 5) are 30. Carry 3 to the tens' column; 10, 14, 22, 26, and think **4** (writing 4) are 30. Carry 3 to the next column; 7, 10, and think **8** (writing 8) are 18.

TEST

Cover 1800 (the minuend) with a piece of paper. On this write the total of 845 (the remainder) and the four subtrahends, adding upwards.

1st column. Think 14 (5 + 9), 17, 23, 30. Write 0.
2d column. Carrying 3; think 7, 14, 18, 26, 30. Write 0.
3d column. Carrying 3; think 11, 15, 18. Write 18.

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2. Find remainders:

a. 1234 − (164 + 587)   *b.* 1863 − (659 + 86 + 203)
c. 2000 − (317 + 865)   *d.* 2456 − (735 + 97 + 888)
e. 2468 − (676 + 943)   *f.* 3248 − (874 + 95 + 875)

Written Problems

1. How much change should a boy receive from $1 when he buys articles costing 9 cents, 17 cents, 29 cents, and 38 cents, respectively?

2. A man had 600 bushels of wheat. How many bushels are left after he has sold 184 bushels, 97 bushels, and 48 bushels?

Sight Problems

1. A's farm contains 20 acres more than B's. B's contains 110 acres. How many acres are there (*a*) in A's farm? (*b*) In both farms?

2. A field is 20 rods long, 12 rods wide. How many rods of fence are needed to enclose it?
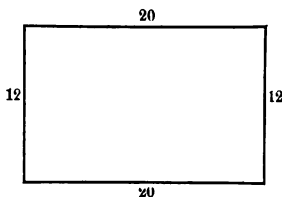
3. John found 24 eggs one afternoon, which was 4 more than he found in the morning. How many did he find that day?

4. A boy lives 14 blocks from school. His uncle lives 2 blocks beyond. How many blocks does he walk in going from his home to his uncle's and returning?

5. A has 40 sheep; B has 20 more than A; C has 12 fewer than B. How many sheep has C?

6. After taking 5 gallons and 6 gallons of oil from a barrel, there are 34 gallons left. How many gallons were there in the barrel at first?

7. How many gallons per minute are discharged by two pipes when one discharges 25 gallons per minute and the other 7 gallons less?

8. How many times does a clock strike (*a*) in the first three hours: 1 o'clock, 2 o'clock, and 3 o'clock? (*b*) In the next three: 4 o'clock, 5 o'clock, and 6 o'clock? (*c*) In the next three: 7 o'clock, 8 o'clock, and 9 o'clock? (*d*) In the next three: 10 o'clock, 11 o'clock, and 12 o'clock?

9. A girl needs 10 cents more to buy a 50-cent doll. How much would she have left if she bought one for 25 cents?

Written Problems

1. A's farm contains 27 acres more than B's. B's contains 109 acres. How many acres are there (*a*) in A's farm? (*b*) In both farms?

2. A field is 67 rods long and 48 rods wide. How many rods of fence are required to enclose it?

3. In the orchard there are 35 pear trees, which is 12 more than the number of plum trees. How many are there of the two kinds?

4. Philadelphia is 90 miles from New York. Baltimore is 94 miles beyond Philadelphia. How many miles are traveled in a trip from New York to Baltimore and return?

5. A has 47 sheep; B has 27 more than A; C has 18 fewer than B. How many sheep has C?

6. After selling 26 gallons and 18 gallons of gasoline, a dealer still has 56 gallons. How many gallons had he at first?

7. How many gallons per minute are discharged by two pipes when one discharges 137 gallons per minute and the other discharges 49 gallons less?

8. If a clock strikes the hours, how many times does it strike (*a*) in 12 hours? (*b*) In a day?

9. To buy a horse for $350 would require $57 more than Mr. Brown has. How much would he have after buying one for $275?

10. At the beginning of the year a school has 376 pupils. During the year 84 new pupils are admitted and 92 leave. How many pupils are there at the end of the year?

11. A man was 47 years old in 1898; how old was he in 1913?

Multiplying Whole Numbers

Preparatory Exercises

1. Count:
- *a.* By 2's to 18.
- *b.* By 3's to 27.
- *c.* By 4's to 36.
- *d.* By 5's to 45.
- *e.* By 6's to 54.
- *f.* By 7's to 63.
- *g.* By 8's to 72.
- *h.* By 9's to 81.

2. Give tables of:
- *a.* 2 times 2 to 2 times 9.
- *b.* 3 times 2 to 3 times 9.
- *c.* 4 times 2 to 4 times 9.
- *d.* 5 times 2 to 5 times 9.
- *e.* 6 times 2 to 6 times 9.
- *f.* 7 times 2 to 7 times 9.
- *g.* 8 times 2 to 8 times 9.
- *h.* 9 times 2 to 9 times 9.

3. At 2 pints to the quart, give the number of pints :
- *a.* In 3 qt.
- *b.* In 2 qt.
- *c.* In 9 qt.
- *d.* In 6 qt.
- *e.* In 5 qt.
- *f.* In 8 qt.
- *g.* In 4 qt.
- *h.* In 7 qt.

4. At 3 feet to the yard, give the number of feet :
- *a.* In 2 yd.
- *b.* In 8 yd.
- *c.* In 7 yd.
- *d.* In 3 yd.
- *e.* In 4 yd.
- *f.* In 5 yd.
- *g.* In 6 yd.
- *h.* In 9 yd.

5. At 4 pecks to the bushel, give the number of pecks :
- *a.* In 5 bu.
- *b.* In 4 bu.
- *c.* In 6 bu.
- *d.* In 9 bu.
- *e.* In 3 bu.
- *f.* In 7 bu.
- *g.* In 2 bu.
- *h.* In 8 bu.

6. At 5 cents to the nickel, give the number of cents :
- *a.* In 9 ni.
- *b.* In 5 ni.
- *c.* In 4 ni.
- *d.* In 7 ni.
- *e.* In 8 ni.
- *f.* In 2 ni.
- *g.* In 3 ni.
- *h.* In 6 ni.

7. At 6 ¢ per yard, give the cost :
- *a.* Of 6 yd.
- *b.* Of 9 yd.
- *c.* Of 5 yd.
- *d.* Of 4 yd.
- *e.* Of 7 yd.
- *f.* Of 3 yd.
- *g.* Of 8 yd.
- *h.* Of 2 yd.

Multipliers of One Figure

Drill Exercises

Give products at sight :

a. 51   b. 83   c. 61   d. 72   e. 91   f. 84   g. 51
× 7   × 3   × 6   × 4   × 9   × 2   × 8

h. 92   i. 51   j. 92   k. 61   l. 71   m. 91   n. 74
× 4   × 9   × 3   × 8   × 5   × 7   × 2

o. 71   p. 94   q. 81   r. 93   s. 81   t. 71   u. 82
× 9   × 2   × 6   × 3   × 8   × 6   × 3

Written Exercises

1. How many pounds of hay are raised on 6 acres at the rate of 9804 pounds to the acre ?

PROCESS

Multiplicand   9084 lb.   Think 6 times 4 are 24; write
Multiplier   6   4 and carry 2. Think 6 times 8
Product   54504 lb.   are 48, carrying 2 makes 50;
                            write 0 and carry 5. Think 6
times 0 are 0; carrying 5 makes 5; write 5. Think 6 times 9
are 54; write 54.

TEST

Cover the answer with a piece of paper. On the   9084 lb.
latter write the product of 9084 by 2, and then mul-   2
tiply this product by 3. Remove the paper and com-   18168 lb.
pare the final product with the one obtained by   3
multiplying 9084 by 6.   54504 lb.

---

2. Multiply 8475 (*a*) by 6. (*b*) By 4. (*c*) By 8. (*d*) By 9. Test.

3. Multiply 7608 (*a*) by 4. (*b*) By 6. (*c*) By 8. (*d*) By 9. Test.

Multiplying Dollars and Cents

1. Find the cost of 9 suits of clothes at $18.75 each.

PROCESS		TEST
$18.75 × 9 $168.75	In multiplying dollars and cents, write a decimal point in the product under the decimal point in the multiplicand.	$18.75 × 3 56.25 × 3 $168.75

2. Find products:

a. $20.43	b. $7.84	c. $260.75	d. $0.55
× 6	× 7	× 8	× 9

3. What is the cost of 285 pounds of sugar at 6 cents a pound?

PROCESS
$.06 × 285 $17.10   At six cents per pound, 285 pounds will cost 285 times 6 cents. In practice, however, use 6 as the multiplier. Point off two decimals in the result.

4. Multiply:

a. $.03	b. $.04	c. $.05	d. $.06	e. $.08
× 248	× 123	× 345	× 218	× 154

Dividing Dollars and Cents — Divisor an Abstract Number

Preparatory Exercises

1. How much does each boy receive when $1 is divided (a) Between 2 boys? (b) Among 4 boys?

2. a. $1 ÷ 2 = ?   b. $1 ÷ 4 = ?   c. $1 ÷ 5 = ?

3. Give quotients:

a. 2)50¢   b. 3)$3.60   c. 4)$1.60   d. 4)$4.40

Written Exercises

1. A farmer's profits on 5 acres of land were $467.65. What was his average profit per acre?

	PROCESS	TEST
5)$467.65	Place a decimal point in the quotient under the decimal point in the dividend.	$93.53
$93.53 *Ans.*		× 5
		$467.65

2. Divide $85.80 (*a*) by 3. (*b*) By 4. (*c*) By 5.

3. Divide $95.76 (*a*) by 6. (*b*) By 7. (*c*) By 8.

Cents as Divisors

Preparatory Exercises

1. At 5 cents each how many pies can be bought (*a*) for 25 cents? (*b*) For 50 cents? (*c*) For $1? (*d*) For $2?

2. How many times is (*a*) 5 ¢ contained in 40 ¢? (*b*) 10 ¢ in $1? (*c*) 5 ¢ in $5?

Written Exercises

1. At 5 ¢ each, how many baseballs can be bought (*a*) for $2.85? (*b*) For $3?

PROCESS	
(*a*) 5 ¢)285 ¢	(*b*) 5 ¢)300 ¢
Ans. 57 (baseballs)	*Ans.* 60 (baseballs)

Write both the divisor and the dividend as cents. The quotient represents the *number* of baseballs. Write *baseballs* in a parenthesis.

2. Find quotients:

a. $.05)$3.70   *b.* $.04)$9.00   *c.* $.08)$54

Divisors of One Figure

Drill Exercises

Give quotients at sight:

a. 2)188   *b.* 3)219   *c.* 4)328   *d.* 5)455   *e.* 6)366

f. 7)357   *g.* 8)568   *h.* 9)459   *i.* 8)408   *j.* 7)497

k. 6)546   *l.* 5)355   *m.* 4)288   *n.* 3)276   *o.* 2)148

p. 3)216   *q.* 4)328   *r.* 5)405   *s.* 6)486   *t.* 7)637

Written Exercises

1. When 7 acres yield 63581 pounds of hay, what is the average yield of 1 acre?

> **PROCESS**
>
> Divisor 7)63581 lb.   Dividend   Think 7 into 63
> *Ans.* 9083 lb.   Quotient   (goes) 9 times;
>   write 9 under 3.
>
> Think 7 into 5 (goes) 0 times with 5 remainder; write 0 under 5. Combine 5 (remainder) with 8 making 58; think 7 into 58 (goes) 8 times with 2 remainder; write 8 under 8. Combine 2 with 1 making 21; think 7 into 21 (goes) 3 times; write 3 under 1.
>
> **TEST**
>
> Cover the dividend with a piece of   Quotient   9083 lb.
> paper. On the latter write the product   Divisor   ×7
> of 9083 (the quotient) by 7 (the divisor)   Dividend   63581 lb.
> without rewriting these numbers.

2. Find quotients.   Test.

   a. 2)98760   *b.* 3)87654   *c.* 4)75436   *d.* 5)16835

   e. 6)19332   *f.* 7)90594   *g.* 8)94528   *h.* 9)48366

   i. 8)10848   *j.* 7)25830   *k.* 6)20136   *l.* 5)76030

Multiplication

Written Exercises

1. Multiply 46078 by 7.

```
  46078              TEST
      7       As 7 is a prime number, test the product by di-
7)322546    viding it by 7.  Write the quotient on the paper
  46078     used to cover the multiplicand.
```

NOTE. — A *prime number* has no factors; 1, 2, 3, 5, 7, 11, etc., are prime numbers.

2. Find products. Test by division.

Multiply by 7: *a.* 40632 *b.* 24079 *c.* 56387 *d.* 35790

Remainders in Division

Written Exercises

1. When 8 acres yield 975 bushels of potatoes, how many bushels are yielded on an average by 1 acre?

```
                        PROCESS
     8)1095         Write 7 (the final remainder) over 8
Ans.    136⅞ bu.   (the divisor) as the fraction ⅞.

                         TEST
  Cover the dividend with a piece of paper.  Think 8 sixes are 48,
carry 7 (the remainder) making 55; write 5 and carry 5.  Think
8 threes are 24, carry 5 making 29; write 9 and carry 2, etc.
```

2. Find quotients. Test.

Divide by 7: *a.* 406321 *b.* 240792 *c.* 563873 *d.* 35794
Divide by 8: *e.* 356785 *f.* 350676 *g.* 135797 *h.* 268508
Divide by 9: *i.* 747870 *j.* 516782 *k.* 657913 *l.* 678985

Sight Problems

1. When 8 gallons of milk weigh 69 pounds, what is the weight of a gallon?

2. What is the weekly cost of a cow's feed at the rate of $21\frac{2}{7}$ cents per day?

3. The weekly cost for labor per cow is 50 cents. Find the cost per day.

4. Find the average weight of an egg when a dozen eggs weigh 23 ounces.

5. What is the average yield per acre when 6 acres yield 13 tons of hay?

Sight Exercises

1. Give quotients:

a. $\frac{48}{5}$ *b.* $\frac{27}{7}$ *c.* $\frac{31}{6}$ *d.* $\frac{48}{9}$ *e.* $\frac{38}{4}$ *f.* $\frac{53}{8}$ *g.* $\frac{31}{3}$

h. $\frac{15}{2}$ *i.* $\frac{38}{3}$ *j.* $\frac{41}{4}$ *k.* $\frac{32}{5}$ *l.* $\frac{37}{8}$ *m.* $\frac{55}{6}$ *n.* $\frac{33}{7}$

o. $\frac{37}{3}$ *p.* $\frac{58}{5}$ *q.* $\frac{44}{7}$ *r.* $\frac{59}{6}$ *s.* $\frac{65}{9}$ *t.* $\frac{43}{4}$ *u.* $\frac{65}{8}$

2. Give dividends:

a. $\frac{?}{5} = 8\frac{3}{5}$ *b.* $\frac{?}{7} = 7\frac{1}{7}$ *c.* $\frac{?}{6} = 5\frac{5}{6}$ *d.* $\frac{?}{9} = 6\frac{2}{9}$

e. $\frac{?}{4} = 9\frac{3}{4}$ *f.* $\frac{?}{8} = 4\frac{3}{8}$ *g.* $\frac{?}{3} = 9\frac{2}{3}$ *h.* $\frac{?}{5} = 7\frac{4}{5}$

i. $\frac{?}{7} = 7\frac{2}{7}$ *j.* $\frac{?}{6} = 8\frac{1}{6}$ *k.* $\frac{?}{9} = 7\frac{5}{9}$ *l.* $\frac{?}{4} = 6\frac{3}{4}$

m. $\frac{?}{8} = 9\frac{3}{8}$ *n.* $\frac{?}{3} = 5\frac{1}{3}$ *o.* $\frac{?}{5} = 8\frac{4}{5}$ *p.* $\frac{?}{7} = 5\frac{6}{7}$

3. Give quotients:

a. $5¢)\overline{60¢}$ *b.* $\$.05)\overline{\$1}$ *c.* $\$.05)\overline{\$1.50}$ *d.* $\$.05)\overline{\$5}$

e. $4¢)\overline{84¢}$ *f.* $\$.04)\overline{\$1}$ *g.* $\$.04)\overline{\$3.60}$ *h.* $\$.04)\overline{\$8}$

i. $3¢)\overline{96¢}$ *j.* $\$.03)\overline{\$3}$ *k.* $\$.03)\overline{\$9.90}$ *l.* $\$.03)\overline{\$9}$

m. $6¢)\overline{66¢}$ *n.* $\$.06)\overline{\$3}$ *o.* $\$.06)\overline{\$5.40}$ *p.* $\$.06)\overline{\$6}$

Multiplying by a Multiple of 10

Sight Exercises

NOTE. — Announce the product of 38 by 10 as three, eighty; the product of 49 by 100 as 49 hundred.

1. Give products:

a.	24	*b.*	22	*c.*	30	*d.*	144
	× 10		× 100		× 30		× 20

e.	24	*f.*	23	*g.*	40	*h.*	231
	× 20		× 200		× 40		× 30

Written Exercises

1. *a.* Find the cost of 469 horses at $300 each.   *b.* At 2000 pounds to a ton how many pounds are there in 384 tons?

PROCESS

a   469
× $300
$140700   *Ans.*

In (*a*) use 300 as the multiplier. Write 0, the product by 0 (ones), in the ones' place. Write 0, the product by 0 (tens), in the tens' place. Write 7, the right-hand figure of the product by 3 (hundreds), in the hundreds' place, etc.

In (*b*) use 2000 as the multiplier. Write 8, the right-hand figure of the product by 2 (thousands), in the thousands' place.

b   384
× 2000 lb.
Ans. 768000 lb.

---

2. Find products:

a.	195	*b.*	240	*c.*	425	*d.*	7150	*e.*	345
	× 200		× 900		× 8000		× 2000		× 300

f.	350	*g.*	350	*h.*	1480	*i.*	659	*j.*	420
	× 600		× 500		× 5000		× 400		× 700

Dividing by a Multiple of 10

Written Exercises

1. At $30 each, how many cows cost $2670?

PROCESS

3|0)267|0
Ans. 89 (cows)

Omit the dollar mark in the divisor and in the dividend. Divide the divisor (30) and the dividend (2670) by 10 by cutting off the terminal cipher in each. Divide 267 by 3 to obtain the number of cows.

Write "cows" in a parenthesis.

NOTE. — When the divisor and the dividend have the same denomination, $, lb., ft., etc., the denomination may be omitted from both.

Dividing the divisor and the dividend by the same number makes no change in the quotient.

2. Find quotients. · (Test by multiplication.)

 a. 80)1920 *c.* 700)37100 *e.* 4000)136000

 b. 90)1950 *d.* 600)73800 *f.* 3000)192000

3. At $50 per acre, how many acres cost $2687?

PROCESS

5|0)268|7
53³⁷⁄₅₀

Cut off 0 in the divisor and 7 in the dividend. In the quotient write 7 as the partial remainder over the divisor 50. Divide 268 by 5, which gives a quotient of 53 and a remainder of 3. Prefix 3 to 7 (the partial remainder), making the complete remainder 37. *Ans.* 53³⁷⁄₅₀ acres.

---

4. Find quotients. Test.

 a. 90)2827 *c.* 700)67241 *e.* 4000)62357

 b. 80)7853 *d.* 600)98767 *f.* 3000)78961

Multipliers of Two or More Figures

Sight Exercises

Give two factors of each of the following:

a. 15 *b.* 21 *c.* 22 *d.* 26 *e.* 33 *f.* 34 *g.* 35 *h.* 38 *i.* 39

Written Exercises

1. Find the weight of 6048 bushels of timothy seed at 45 pounds to the bushel.

6048	**PROCESS**
× 45 lb.	Use 45 as the multiplier, and place the right-hand figure of the product by 5 (ones) under the 5. Place the right-hand figure of the product of 4 (tens) under the 4. Combine the partial products.
30240	
24192	
Ans. 272160 lb.	

2. Find products. Test by using factors.

a. 21 × 5463   *b.* 27 × 6804   *c.* 28 × 5729   *d.* 32 × 6918

e. 36 × 8618   *f.* 42 × 7855   *g.* 45 × 4205   *h.* 48 × 4869

3. Multiply 348 by 607.

348	**PROCESS**
607	Place the product by 7 (ones) under 7, and the product by 6 (hundreds) under 6. Write only two partial products.
2436	
2088	
Ans. 211236	
	TEST
Test the foregoing product by multiplying 607 by 348.	

4. Find products. Test.

   a. 204 × 253   *b.* 942 × 367   *c.* 907 × 805

   d. 346 × 645   *e.* 986 × 623   *f.* 834 × 304

Long Division

1. In digging out a cellar, 8260 cubic feet of earth were removed. At 27 cubic feet to the cubic yard, how many cubic yards were removed ?

PROCESS

Ans. 305$\frac{25}{27}$ (cu. yd.)

27)8260

81

160

135

25

Take 82 as the first partial dividend, divide it by 27, and write 3 (the first figure of the quotient) above 2 (the last figure of the first partial dividend). Multiply 27 by 3, and write 81 (the product) under 82. To 1 (the remainder) annex 6 (the third figure of the dividend), making 16 the second partial dividend. Since this does not contain 27, write 0 above 6, as the second figure of the quotient, and annex 0 (the last figure of the dividend) to 16, making 160 the third partial dividend. Since 160 contains the divisor 5 times, write 5 above 0, as the third figure of the quotient. Multiply the divisor by 5, place 135 (the product) under 160, and subtract. Write 25 (the final remainder) over 27 (the divisor) in the form of the fraction $\frac{25}{27}$.

TEST

Multiply 305 (the whole number in the quotient) by 27 (the divisor). To 8235 (the product) add 25 (the remainder). Since the sum, 8260, is the same as the dividend, the original answer is probably correct.

Quotient	305
Divisor	27
	2135
	610
	8235
Remainder	25
Dividend	8260

---

2. How many cubic yards of earth were removed from an excavation containing 9473 cubic feet ?

3. At 22 cubic feet to the load, how many loads will 9482 cubic feet make ?

Written Exercises

1. Divide. Test :

a. 675 ÷ 27	*b.* 6755 ÷ 27	*c.* 6775 ÷ 271
d. 865 ÷ 34	*e.* 6971 ÷ 34	*f.* 8530 ÷ 341
g. 245 ÷ 17	*h.* 2451 ÷ 17	*i.* 2451 ÷ 172
j. 307 ÷ 27	*k.* 3072 ÷ 27	*l.* 3072 ÷ 273
m. 573 ÷ 38	*n.* 5733 ÷ 38	*o.* 5733 ÷ 384
p. 645 ÷ 48	*q.* 6454 ÷ 48	*r.* 6454 ÷ 485

2. Find quotients. Test *!*

a. 24516 ÷ 172	*b.* 245161 ÷ 1721
c. 30725 ÷ 273	*d.* 307252 ÷ 2732
e. 57334 ÷ 384	*f.* 573343 ÷ 3843
g. 64543 ÷ 485	*h.* 645434 ÷ 4854
i. 87652 ÷ 596	*j.* 876525 ÷ 5965

3. Divide 35417 by 1800.

PROCESS

Ans. $19\frac{1217}{1800}$

$18|00\overline{)354|17}$
$\quad\underline{18}$
$\quad\overline{174}$
$\quad\underline{162}$
$\quad\overline{\;12}$

Cut off the two terminal ciphers in the divisor, and the last two figures of the quotient. Divide 354 by 18. To the partial remainder 12 annex 17, the quotient figures cut off, making 1217 the complete remainder. Underneath this remainder write 1800 (the divisor) in the form of a fraction.

TEST

To the product of 19 (the partial quotient) by 1800 (the divisor) add 1217 (the remainder). The result should equal the dividend.

4. Find quotients. Test:

a. 64813 ÷ 1800	*b.* 64813 ÷ 1890	*c.* 73245 ÷ 2700
d. 73245 ÷ 2780	*e.* 46157 ÷ 3600	*f.* 46157 ÷ 3670

Divisors Containing Cents

5. At 95 cents per bushel how many bushels of wheat can be bought for $76?

PROCESS

Ans. 80 (bushels)
95)7600
760
———
0

Write the divisor and the dividend as cents, but omit the words "cents." The quotient will be the *number* of bushels.

---

6. Divide:

a. $24 ÷ 25¢   *b.* $37.50 ÷ 75¢   *c.* $31.25 ÷ $1.25

d. $123 ÷ 75¢   *e.* $24 ÷ 48¢   *f.* $48.96 ÷ 51¢

     g. $48.96 ÷ $3.06   *h.* $123 ÷ 15¢

Shortening the Work

Written Exercises

1. At 15 cents per dozen, find the cost of 64 lemons.

PROCESS

$$\frac{\overset{5}{\cancel{15}}¢ \times \overset{16}{\cancel{64}}}{\underset{4}{\cancel{12}}} = 80¢ \ \ Ans.$$

Write 15¢ above the line and 12 below it to indicate the cost of 1 lemon. Then above the line write 64 preceded by a multiplication sign, to indicate the cost of 64 lemons. Divide 12 and 15 by 3, drawing a cancellation line through both, and write 4 below 12 and 5 above 15. Cancel 4 and 64, and write 16 above the latter. Write 80¢ (16 times 5¢) as the required answer. Test by finding the cost of 1 lemon and multiplying the result by 64.

---

2. When 27 acres yield 555 bushels of wheat, what should be the yield of 36 acres?

Cancellation

Cancellation consists in rejecting the same* factor from a divisor and a dividend.

3. Find answers:

a. $\dfrac{27 \times 16}{12}$ b. $\dfrac{25 \times 84}{75}$ c. $\dfrac{21 \times 40}{14}$ d. $\dfrac{56 \times 18}{24}$

e. $\dfrac{37 \times 32}{74}$ f. $\dfrac{36 \times 96}{48}$ g. $\dfrac{65 \times 42}{26}$ h. $\dfrac{43 \times 24}{86}$

i. $\dfrac{25 \times 76}{95}$ j. $\dfrac{32 \times 27}{54}$ k. $\dfrac{70 \times 20}{140}$ l. $\dfrac{38 \times 36}{72}$

4. If a barrel of gasoline will drive an engine 9 hours a day for 14 days, how many barrels will be required to run it 8 hours a day for 84 days?

PROCESS

$$\frac{\overset{\overset{2}{6}}{\cancel{84}} \times 8}{\underset{\underset{3}{9}}{\cancel{14}} \times \cancel{9}} = \frac{16}{3} = 5\tfrac{1}{3} \text{ (bbl.) } Ans.$$

Indicate the number of hours it is required to run, by writing 84 × 8. Indicate the number of hours 1 barrel will last by writing 14 × 9, placing this indicated product below the line (as a divisor). Cancel 14 and 84, writing 6 above the latter. Cancel 6 and 9 by dividing each by 3, writing 2 above the former and 3 below the latter. Write 16 (2 × 8) as the numerator of an improper fraction and 3 as its denominator. Change $\tfrac{16}{3}$ to a mixed number. Write bbl. in a parenthesis.

---

5. Find answers:

a. $\dfrac{14 \times 9}{8 \times 84}$ b. $\dfrac{10 \times 88}{11 \times 12}$ c. $\dfrac{11 \times 12}{10 \times 88}$ d. $\dfrac{70 \times 20}{14 \times 75}$

e. $\dfrac{14 \times 75}{70 \times 20}$ f. $\dfrac{14 \times 25}{70 \times 20}$ g. $\dfrac{50 \times 14}{70 \times 20}$ h. $\dfrac{70 \times 20}{20 \times 14}$

Sight Problems

1. A's farm is twice as large as B's. B's contains 80 acres. How many acres are there (*a*) in A's farm? (*b*) In both farms?

2. How many square rods are there in a rectangular field 20 rods long and 12 rods wide?

3. John has saved 7 cents. His sister has saved three times as much. How many cents have both saved?

4. After filling 3 five-gallon cans with oil from a barrel there are 30 gallons left in the latter. How many gallons were in it at first?

5. One pipe discharges 40 gallons in 2 minutes, the other discharges 36 gallons in 3 minutes. How many gallons per minute do both together discharge?

6. How many times does a clock tick in 5 minutes if it ticks 60 times a minute?

7. At the rate of 31 miles per hour, how far will a train go from 1 P.M. to 10 P.M.?

8. A man bought a wagon for $100 and spent $20 on repairs. What was his profit, if he sold it for $150?

9. A train that was due at 9.15 A.M. did not arrive until 10 A.M. How many minutes late was it?

10. How much change should a girl receive if she buys 63 cents' worth of groceries and gives the storekeeper a $1 bill?

11. I bought 2 pounds of coffee and gave the storekeeper 75 cents. If he gave me 15 cents in change, what was the price of the coffee per pound?

12. A 160-acre farm is divided into 4 fields of the same size. One field yielded 120 tons of hay. What was the yield per acre?

Written Problems

1. X's farm is three times as large as Y's. Y's contains 97 acres. How many acres are there (*a*) in X's farm? (*b*) In both farms?

2. How many square rods are there in a rectangular field 27 rods long and 24 rods wide?

3. A farmer paid $13 for a calf and four times as much for a cow. What did he pay for both?

4. After filling 3 forty-five gallon barrels of oil from a tank the latter still contains 95 gallons. How many gallons did it contain at first?

5. One pipe discharges 169 gallons in 13 minutes. Another discharges 196 gallons in 14 minutes. How many gallons per minute do both together discharge?

6. How many times does a clock strike in a week if it strikes 156 times a day?

7. At the rate of 28 miles per hour, how far will a train go from 2 P.M. to 3 A.M.?

8. A man bought a carriage for $275. After spending $47 for repairs he sold it for $350. What was his profit?

9. How many minutes late was a train that was due at 9.15 A.M. and did not arrive until 10.26 A.M.?

10. How much change should a man receive if he buys 4 yards of cloth at $1.35 per yard, and gives 3 two-dollar bills in payment?

11. I bought 14 pounds of coffee and received $6.50 change out of a 10-dollar bill. What did the coffee cost per pound?

Fractions

Preparatory Exercises

A   B   C   D   E
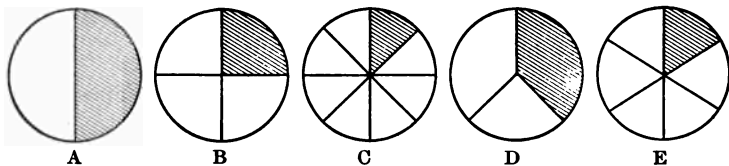
1. Into how many parts is A divided? B? C? D? E?

2. If A were placed upon B, how many parts of B would be covered (*a*) by the shaded part of A? (*b*) By the white part of A?

3. If A were placed upon C, how many parts of C would be covered (*a*) by the white part of A? (*b*) By the shaded part of A?

4. If A were placed upon E, how many parts of E would be covered (*a*) by the white part of A? (*b*) By the shaded part of A?

5. If B were placed upon C, how many parts of C would be covered (*a*) by the shaded part of B? (*b*) By the white part of B?

6. If D were placed upon E, how many parts of E would be covered (*a*) by the shaded part of D? (*b*) By the white part of D?

7. What fraction is shaded (*a*) in A? (*b*) In B? (*c*) In C? (*d*) In D? (*e*) In E?

8. What fraction is white (*a*) in A? (*b*) in B? (*c*) In C? (*d*) In D? (*e*) In E?

When $\frac{8}{12}$ is changed to $\frac{4}{6}$, it is reduced to *lower terms;* when it is changed to $\frac{2}{3}$, it is reduced to *lowest terms;* when it is changed to $\frac{16}{24}$ or to $\frac{24}{36}$, it is expressed in *higher terms.*

Reductions

Sight Exercises

1. Change $\frac{1}{2}$ (*a*) to fourths, (*b*) to eighths, (*c*) to sixths.

2. Change $\frac{1}{3}$ (*a*) to sixths, (*b*) to ninths, (*c*) to twelfths.

3. Give answers :

$a.\ \frac{1}{2}=\frac{?}{4}$ $b.\ \frac{1}{2}=\frac{?}{8}$ $c.\ \frac{1}{2}=\frac{?}{6}$ $d.\ \frac{1}{2}=\frac{?}{10}$

$e.\ \frac{1}{4}=\frac{?}{8}$ $f.\ \frac{1}{4}=\frac{?}{12}$ $g.\ \frac{3}{4}=\frac{?}{8}$ $h.\ \frac{3}{4}=\frac{?}{12}$

$i.\ \frac{1}{3}=\frac{?}{6}$ $j.\ \frac{2}{3}=\frac{?}{6}$ $k.\ \frac{1}{3}=\frac{?}{12}$ $l.\ \frac{2}{3}=\frac{?}{12}$

4. Change to inches :

   $a.\ \frac{1}{2}$ ft. $b.\ \frac{1}{4}$ ft. $c.\ \frac{1}{3}$ ft. $d.\ \frac{2}{3}$ ft. $e.\ \frac{3}{4}$ ft.

5. Change to ounces :

   $a.\ \frac{1}{2}$ lb. $b.\ \frac{1}{4}$ lb. $c.\ \frac{3}{4}$ lb. $d.\ \frac{1}{8}$ lb. $e.\ \frac{3}{8}$ lb.

6. Change to minutes :

   $a.\ \frac{1}{2}$ hr. $b.\ \frac{1}{3}$ hr. $c.\ \frac{1}{4}$ hr. $d.\ \frac{2}{3}$ hr. $e.\ \frac{1}{5}$ hr.

7. Express as whole or as mixed numbers :

   $a.\ \frac{16}{2}$ $b.\ \frac{12}{4}$ $c.\ \frac{27}{3}$ $d.\ \frac{17}{2}$ $e.\ \frac{15}{4}$ $f.\ \frac{29}{3}$ $g.\ \frac{21}{2}$

8. Change to fourths :

   $a.\ 8\frac{1}{4}$ $b.\ 9\frac{1}{4}$ $c.\ 5\frac{1}{4}$ $d.\ 7\frac{1}{4}$ $e.\ 4\frac{3}{4}$ $f.\ 3\frac{3}{4}$ $g.\ 6\frac{3}{4}$

9. Change to improper fractions :

   $a.\ 8\frac{1}{8}$ $b.\ 9\frac{1}{2}$ $c.\ 5\frac{2}{3}$ $d.\ 7\frac{1}{8}$ $e.\ 4\frac{1}{4}$ $f.\ 3\frac{3}{8}$ $g.\ 6\frac{5}{8}$

10. Reduce to lowest terms :

   $a.\ \frac{2}{4}$ $b.\ \frac{5}{10}$ $c.\ \frac{4}{8}$ $d.\ \frac{6}{12}$ $e.\ \frac{2}{8}$ $f.\ \frac{6}{8}$ $g.\ \frac{3}{6}$

   $h.\ \frac{2}{6}$ $i.\ \frac{4}{6}$ $j.\ \frac{3}{9}$ $k.\ \frac{6}{9}$ $l.\ \frac{2}{10}$ $m.\ \frac{4}{10}$ $n.\ \frac{6}{10}$

11. Change to inches :

   a. 3 ft.   *b.* 1 ft. 6 in.   *c.* 2 ft. 3 in.   *d.* 3 ft. 5 in.

12. Change to ounces:

    a. 2 lb. *b.* 1 lb. 6 oz. *c.* 2 lb. 3 oz. *d.* 3 lb. 2 oz.

13. Reduce to pints:

    a. 2 gal. *b.* 1 qt. 1 pt. *c.* 2 qt. 1 pt. *d.* 3 qt. 1 pt.
    e. 10 qt. 1 pt.

14. Reduce to quarts:

    a. 1 bu. *b.* 1 pk. 1 qt. *c.* 2 pk. 1 qt. *d.* 3 pk. 3 qt.
    e. 10 pk. 1 qt.

15. Change to the fraction of a foot:

    a. 6 in. *b.* 4 in. *c.* 3 in. *d.* 2 in. *e.* 1 in.
    f. 9 in. *g.* 8 in. *h.* 5 in. *i.* 10 in.

16. Change to the fraction of a dollar:

    a. 50 ¢ *b.* 25 ¢ *c.* 75 ¢ *d.* 20 ¢ *e.* 40 ¢ *f.* 60 ¢

17. Change to the fraction of a pound:

    a. 8 oz. *b.* 10 oz. *c.* 2 oz. *d.* 9 oz. *e.* 6 oz.
    f. 4 oz. *g.* 12 oz.

18. Change to cents:

    a. $\$\frac{1}{4}$ *b.* $\$\frac{3}{4}$ *c.* $\$\frac{1}{5}$ *d.* $\$\frac{2}{5}$ *e.* $\$\frac{4}{5}$ *f.* $\$\frac{3}{5}$

19. Change to the fraction of a year:

    a. 1 mo. *b.* 2 mo. *c.* 3 mo. *d.* 4 mo. *e.* 5 mo.
    f. 6 mo. *g.* 9 mo. *h.* 8 mo. *i.* 10 mo.

20. Change to the fraction of a month of 30 days:

    a. 10 da. *b.* 15 da. *c.* 20 da. *d.* 6 da. *e.* 12 da.
    f. 18 da. *g.* 25 da. *h.* 24 da. *i.* 9 da. *j.* 21 da.

21. Change to months:

    a. 3 yr. 6 mo.   *b.* 4 yr. 4 mo.   *c.* 1 yr. 8 mo.
    d. 2 yr. 6 mo.   *e.* 5 yr. 3 mo.   *f.* 6 yr. 1 mo.

Adding and Subtracting Fractions

Sight Exercises

1. Give sums:

a. 2 ninths
    $+$ 2 ninths

b. $\frac{1}{9}$
  $+\frac{1}{9}$

c. $\frac{4}{9}$
  $+\frac{1}{9}$

d. $\frac{4}{9}$
  $+\frac{4}{9}$

e. $\frac{2}{9}$
  $+\frac{5}{9}$

f. 2 sevenths
    $+$ 3 sevenths

g. $\frac{2}{7}$
  $+\frac{2}{7}$

h. $\frac{3}{7}$
  $+\frac{3}{7}$

i. $\frac{4}{7}$
  $+\frac{3}{7}$

j. $\frac{3}{7}$
  $+\frac{1}{7}$

k. 2 fifths
    $+$ 2 fifths

l. $\frac{1}{5}$
  $+\frac{2}{5}$

m. $\frac{3}{5}$
  $+\frac{1}{5}$

n. $\frac{1}{5}$
  $+\frac{1}{5}$

o. $\frac{1}{5}$
  $+\frac{3}{5}$

2. Give remainders:

a. 4 ninths
    $-$ 2 ninths

b. $\frac{8}{9}$
  $-\frac{1}{9}$

c. $\frac{7}{9}$
  $-\frac{2}{9}$

d. $\frac{8}{9}$
  $-\frac{4}{9}$

e. $\frac{5}{9}$
  $-\frac{1}{9}$

f. 3 fifths
    $-$ 2 fifths

g. $\frac{4}{5}$
  $-\frac{1}{5}$

h. $\frac{4}{5}$
  $-\frac{3}{5}$

i. $\frac{3}{5}$
  $-\frac{1}{5}$

j. $\frac{2}{5}$
  $-\frac{1}{5}$

k. 5 sevenths
    $-$ 3 sevenths

l. $\frac{4}{7}$
  $-\frac{2}{7}$

m. $\frac{6}{7}$
  $-\frac{3}{7}$

n. $\frac{5}{7}$
  $-\frac{2}{7}$

o. $\frac{4}{7}$
  $-\frac{1}{7}$

3. Give results in lowest terms:

a. $\frac{1}{4}$
  $+\frac{1}{4}$

b. $\frac{1}{6}$
  $+\frac{1}{6}$

c. $\frac{1}{8}$
  $+\frac{1}{8}$

d. $\frac{1}{8}$
  $+\frac{3}{8}$

e. $\frac{1}{9}$
  $+\frac{2}{9}$

f. $\frac{1}{12}$
  $+\frac{5}{12}$

g. $\frac{1}{9}$
  $+\frac{5}{9}$

h. $\frac{3}{8}$
  $+\frac{3}{8}$

i. $\frac{1}{10}$
  $+\frac{3}{10}$

j. $\frac{7}{10}$
  $+\frac{1}{10}$

k. $\frac{1}{15}$
  $+\frac{4}{15}$

l. $\frac{5}{12}$
  $+\frac{5}{12}$

m. $\frac{1}{8}$
  $+\frac{5}{8}$

n. $\frac{1}{12}$
  $+\frac{1}{12}$

o. $\frac{1}{12}$
  $+\frac{7}{12}$

4. Give remainders in lowest terms:

a. $\frac{1}{2}$ b. $\frac{3}{4}$ c. $\frac{3}{4}$ d. $\frac{1}{3}$ e. $\frac{5}{6}$

$-\frac{1}{4}$ $-\frac{1}{4}$ $-\frac{1}{2}$ $-\frac{1}{6}$ $-\frac{1}{2}$

f. $\frac{1}{2}$ g. $\frac{1}{2}$ h. $\frac{1}{2}$ i. $\frac{3}{8}$ j. $\frac{5}{8}$

$-\frac{1}{6}$ $-\frac{1}{8}$ $-\frac{3}{8}$ $-\frac{1}{4}$ $-\frac{1}{2}$

k. $\frac{7}{8}$ l. $\frac{7}{8}$ m. $\frac{7}{8}$ n. $\frac{7}{8}$ o. $\frac{7}{8}$

$-\frac{1}{8}$ $-\frac{3}{8}$ $-\frac{5}{8}$ $-\frac{1}{4}$ $-\frac{1}{2}$

5. Give answers in whole or in mixed numbers. Express fractions in answers in lowest terms.

a. $\frac{1}{2}$ b. $\frac{1}{3}$ c. $\frac{2}{3}$ d. $\frac{3}{4}$ e. $\frac{5}{8}$

$+\frac{1}{2}$ $+\frac{2}{3}$ $+\frac{2}{3}$ $+\frac{3}{4}$ $+\frac{5}{8}$

f. $\frac{1}{2}$ g. $\frac{1}{2}$ h. $\frac{1}{2}$ i. $\frac{1}{3}$ j. $\frac{2}{3}$

$+\frac{2}{3}$ $+\frac{3}{4}$ $+\frac{5}{6}$ $+\frac{5}{6}$ $+\frac{5}{6}$

6. Give remainders:

a. 1 b. 1 c. 1 d. 1 e. 1

$-\frac{1}{2}$ $-\frac{1}{3}$ $-\frac{2}{3}$ $-\frac{1}{4}$ $-\frac{3}{4}$

f. 1 g. $1\frac{1}{3}$ h. $1\frac{1}{4}$ i. $1\frac{1}{4}$ j. $1\frac{1}{8}$

$-\frac{5}{6}$ $-\frac{2}{3}$ $-\frac{3}{4}$ $-\frac{1}{2}$ $-\frac{3}{8}$

k. $1\frac{1}{8}$ l. $1\frac{1}{8}$ m. 2 n. 2 o. 2

$-\frac{7}{8}$ $-\frac{1}{2}$ $-\frac{1}{2}$ $-1\frac{1}{2}$ $-\frac{1}{4}$

7. Add:

a. $\frac{1}{2}$ b. $\frac{1}{3}$ c. $\frac{1}{4}$ d. $\frac{1}{6}$ e. $\frac{1}{2}$ f. $\frac{1}{2}$

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{6}$ $\frac{1}{4}$ $\frac{1}{4}$

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{6}$ $\frac{1}{2}$ $\frac{1}{4}$

Adding Mixed Numbers

Sight Exercises

1. A man bought a suit of clothes for 27\frac{3}{4}$ and a pair of shoes for 3\frac{3}{4}$. How much did he pay for both?

<table>
<tr><td colspan="2" align="center">PROCESS</td></tr>
<tr><td>$27\frac{3}{4}$</td><td>Find the sum of the fractions ($\frac{6}{4}$), change $\frac{6}{4}$ to</td></tr>
<tr><td>$2\frac{3}{4}$</td><td>$1\frac{2}{4}$, and then to $1\frac{1}{2}$. Write $\frac{1}{2}$ under the fractions,</td></tr>
<tr><td>$30\frac{1}{2}$ *Ans.*</td><td>carry 1 to the whole numbers, etc.</td></tr>
</table>

2. Give sums:

a. $19\frac{1}{2}$	*b.* $19\frac{1}{4}$	*c.* $18\frac{3}{4}$	*d.* $16\frac{3}{4}$	*e.* $15\frac{3}{4}$
$+\ 9\frac{1}{2}$	$+\ 8\frac{1}{4}$	$+\ 6\frac{1}{4}$	$+\ 5\frac{1}{2}$	$+\ 4\frac{3}{4}$

f. $20\frac{1}{3}$	*g.* $22\frac{1}{3}$	*h.* $34\frac{2}{3}$	*i.* $42\frac{1}{6}$	*j.* $12\frac{5}{6}$
$+\ 5\frac{1}{3}$	$+\ 6\frac{2}{3}$	$+\ 3\frac{2}{3}$	$+\ 4\frac{1}{6}$	$+\ 8\frac{1}{6}$

k. $30\frac{1}{8}$	*l.* $52\frac{1}{8}$	*m.* $18\frac{1}{8}$	*n.* $27\frac{1}{8}$	*o.* $30\frac{3}{8}$
$+\ 5\frac{1}{8}$	$+\ 6\frac{3}{8}$	$+\ 2\frac{5}{8}$	$+\ 3\frac{7}{8}$	$+\ \frac{3}{8}$

Written Exercises

1. Find sums:

a. $24\frac{1}{2}$	*b.* $14\frac{1}{2}$	*c.* $32\frac{1}{4}$	*d.* $18\frac{1}{4}$	*e.* $23\frac{1}{4}$
$6\frac{1}{2}$	$7\frac{1}{2}$	$25\frac{1}{4}$	$42\frac{1}{4}$	$9\frac{3}{4}$
30	$39\frac{1}{2}$	6	$9\frac{1}{4}$	$6\frac{1}{4}$

f. $62\frac{3}{4}$	*g.* $22\frac{3}{4}$	*h.* $19\frac{1}{2}$	*i.* $34\frac{1}{4}$	*j.* $47\frac{1}{2}$
$5\frac{3}{4}$	$16\frac{1}{4}$	$4\frac{1}{4}$	$16\frac{1}{4}$	$2\frac{3}{4}$
29	$52\frac{3}{4}$	$40\frac{1}{4}$	$15\frac{1}{2}$	24

k. $55\frac{1}{2}$	*l.* $44\frac{3}{4}$	*m.* $33\frac{3}{4}$	*n.* $22\frac{1}{3}$	*o.* $11\frac{2}{3}$
$10\frac{3}{4}$	$20\frac{3}{4}$	$8\frac{3}{4}$	$20\frac{1}{3}$	$12\frac{1}{3}$
$4\frac{1}{2}$	$5\frac{1}{2}$	$16\frac{3}{4}$	$9\frac{1}{3}$	13

Subtracting Mixed Numbers

Sight Exercises

1. Give remainders :

a. 16	*b.* 20	*c.* 30	*d.* 25	*e.* 44
$-\frac{1}{2}$	$-\frac{1}{4}$	$-\frac{3}{4}$	$-\frac{1}{8}$	$-\frac{2}{3}$

f. 16	*g.* 20	*h.* 30	*i.* 25	*j.* 44
$-5\frac{1}{2}$	$-4\frac{1}{4}$	$-9\frac{3}{4}$	$-4\frac{1}{8}$	$-3\frac{2}{3}$

2. Subtract :

a. $10\frac{1}{2}$	*b.* $11\frac{2}{3}$	*c.* $12\frac{1}{3}$	*d.* $13\frac{5}{6}$	*e.* $14\frac{5}{6}$
$-3\frac{1}{2}$	$-6\frac{1}{2}$	$-7\frac{1}{6}$	$-8\frac{1}{6}$	$-9\frac{1}{3}$

f. $29\frac{5}{6}$	*g.* $38\frac{5}{8}$	*h.* $47\frac{7}{8}$	*i.* $36\frac{7}{8}$	*j.* $25\frac{7}{8}$
$-8\frac{1}{2}$	$-4\frac{2}{3}$	$-\frac{1}{8}$	$-\frac{3}{8}$	$-\frac{5}{8}$

Written Exercises

1. From a farm of 160 acres $87\frac{3}{4}$ acres were sold. How many acres were left ?

160 A.
$-\ 87\frac{3}{4}$
Ans. $\overline{\ \ 72\frac{1}{4}}$ A.

PROCESS

Think $\frac{3}{4}$ and $\frac{1}{4}$ (writing $\frac{1}{4}$) are 1. Carry 1 to 7, making 8, and think 8 and **2** (writing 2) are 10. Carry 1 to 8, making 9, and think 9 and **7** (writing 7) are 16.

Cover 160 A. (the minuend) with a piece of paper. On the latter write the sum of $72\frac{1}{4}$ and $87\frac{3}{4}$, adding upward.

TEST

Think $\frac{1}{4}$ and $\frac{3}{4}$ are 1; carrying 1 to 2, think 3 and 7 are 10; write 0. Carrying 1 to 7, think 8 and 8 are 16; write 16.

2. Subtract. Test :

a. 150	*b.* $240\frac{3}{4}$	*c.* $315\frac{3}{4}$	*d.* 420
$-85\frac{1}{2}$	$-67\frac{1}{4}$	$-98\frac{1}{2}$	$-54\frac{3}{4}$

Sight Problems

1. A's farm contains $4\frac{1}{2}$ acres more than B's. B's contains $95\frac{1}{2}$ acres. How many acres are there. (*a*) in A's farm? (*b*) In both farms?

2. A field is $20\frac{1}{2}$ rods long and $10\frac{1}{2}$ rods wide. How many rods of fence are required to enclose it?

3. A boy lives 10 blocks from the school. His uncle lives $2\frac{1}{2}$ blocks beyond. How many blocks does he walk in going from his home to his uncle's and returning?

4. A raised 40 tons of hay; B raised $10\frac{1}{4}$ tons more than A; C raised $9\frac{1}{4}$ tons less than B. How many tons did C raise?

5. After taking $5\frac{1}{2}$ and $6\frac{1}{4}$ gallons of oil from a barrel, there are $33\frac{1}{4}$ gallons left in the latter. How many gallons did it contain originally?

6. How many gallons per minute are discharged by two pipes, if one discharges $25\frac{1}{4}$ gallons per minute and the other $5\frac{1}{2}$ gallons less?

7. Find the sum of $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, and $4\frac{1}{4}$.

8. A can cut $\frac{1}{2}$ of the grass on a field in a day; B can cut $\frac{1}{8}$ of it in a day; and C can cut $\frac{1}{4}$ of it in a day. What part of the field can the three together cut in a day?

9. A man had $36\frac{1}{2}$ acres of land. How many acres would he have after buying $10\frac{1}{2}$ acres and selling $6\frac{1}{4}$ acres?

10. How long does it require a train to go from A to B if it leaves A at half past 6 in the morning and reaches B at noon?

11. In making a trip of 96 miles, a train goes 34 miles the first hour and four miles less the second hour. How many miles must it go the next hour to finish the trip in 3 hours?

Written Problems

1. A's farm contains $14\frac{3}{4}$ acres more than B's. B's contains $197\frac{3}{8}$ acres. (*a*) How many acres are there in A's farm? (*b*) In both farms?

2. A field is $37\frac{7}{8}$ rods long and $23\frac{1}{2}$ rods wide. How many rods of fence will be required to enclose it?

3. Mr. Brown traveled $43\frac{3}{4}$ miles on Monday. On Tuesday he traveled $8\frac{2}{3}$ miles less than on Monday. How far did he travel in the two days?

4. A raised $40\frac{1}{2}$ tons of hay; B raised $10\frac{3}{8}$ tons more than A; C raised $9\frac{3}{4}$ less than B. How many tons did C raise?

5. After drawing off $15\frac{1}{2}$ and $16\frac{3}{4}$ gallons of oil from a tank it still contains $63\frac{5}{8}$ gallons. How many gallons did it contain originally?

6. How many gallons per minute are discharged by two pipes if one discharges $25\frac{3}{4}$ gallons per minute and the other $6\frac{3}{8}$ gallons less?

7. Find the sum (*a*) of $9\frac{1}{2}$, $10\frac{1}{3}$, and $6\frac{1}{6}$. (*b*) Of 9 ft. 6 in., 10 ft. 4 in., and 6 ft. 2 in.

8. M can do $\frac{5}{24}$ of a piece of work in a day; N can do $\frac{7}{24}$ of it in a day. (*a*) What part of it can both together do in a day? (*b*) How many days would both together require to do the work?

9. A man had $36\frac{7}{8}$ acres of land. How many acres would he have after buying $10\frac{3}{4}$ acres and selling $9\frac{1}{2}$?

10. How long does it require a train to go from M to N if it leaves M at a quarter to 9 Monday night, and reaches N at half past 7 Tuesday morning?

Multiplication — One Fractional Factor

Sight Exercises

1. What is the value of $\frac{3}{4}$ acre of land at the rate of $240 an acre?

$\frac{1}{4}$ of $240 is $60; $\frac{3}{4}$ of $240 is 3 times $60, which is $180. *Ans.*

2. A man bought 240 ducks at $$\frac{3}{4}$ each. How much did he pay for them?

At $$\frac{1}{4}$ each the ducks would cost $60; the cost at $$\frac{3}{4}$ each is 3 times $60, which is $180.

3. Give answers :

a. $\frac{1}{4}$ of 416   *b.* 440 $\times \frac{1}{4}$ *c.* $\frac{1}{2}$ of 240   *d.* 280 $\times \frac{1}{2}$

Written Exercises

1. What is the cost of $\frac{3}{4}$ acre of land at the rate of $264 per acre?

PROCESS	
$$\frac{3}{4} \times \frac{\overset{66}{\cancel{\$264}}}{1} = \$198 \ Ans.$$	Find $\frac{1}{4}$ of $264 by substituting the multiplication sign for "of" and writing 1 under 264 as a denominator. Cancel 4 and 264, etc.

2. A man bought 116 chickens at $$\frac{3}{4}$ each. How much did he pay for them?

PROCESS	
$$\frac{\overset{29}{\cancel{116}}}{1} \times \frac{\$3}{\cancel{4}} = \$87 \ Ans.$$	Write 116 times $$\frac{3}{4}$, placing 1 under 116. Cancel.

3. Find products :

a. $\frac{1}{4}$ of 192   *b.* 144 $\times \frac{1}{4}$ *c.* $\frac{1}{2}$ of 112   *d.* 132 $\times \frac{1}{2}$

e. $\frac{1}{3}$ of 144   *f.* 144 $\times \frac{2}{3}$ *g.* $\frac{3}{4}$ of 192   *h.* 144 $\times \frac{1}{8}$

One Factor a Mixed Number

Sight Exercises

1. At the rate of 60 bushels of corn to the acre, how many bushels would $1\frac{1}{2}$ acres yield?

$1\frac{1}{2}$ acres would yield 60 bushels + 30 bushels ($\frac{1}{2}$ of 60 bushels).

Ans. 90 bushels.

2. Find the cost of 80 yards of cloth at $\$1\frac{1}{2}$ per yard.

80 yards would cost $\$80 + \$40$ ($\frac{1}{2}$ of $\$80$), or $\$120$.   *Ans.*

3. Give answers:

a. $120 + \frac{1}{2}$ of 120   *b.* $1\frac{1}{2} \times 60$ *c.* $40 \times 1\frac{1}{2}$ *d.* $50 \times 1\frac{1}{2}$

e. $120 + \frac{1}{3}$ of 120   *f.* $1\frac{1}{3} \times 60$ *g.* $30 \times 1\frac{1}{3}$ *h.* $40 \times 1\frac{1}{3}$

i. $120 + \frac{1}{4}$ of 120   *j.* $1\frac{1}{4} \times 40$ *k.* $80 \times 1\frac{1}{4}$ *l.* $30 \times 1\frac{1}{5}$

m. $120 + \frac{1}{6}$ of 120   *n.* $1\frac{1}{6} \times 60$ *o.* $30 \times 1\frac{1}{6}$ *p.* $20 \times 1\frac{1}{5}$

4. Give products:

a. $20 \times 1\frac{1}{2}$ *b.* $2\frac{1}{2} \times 20$ *c.* $20 \times 3\frac{1}{2}$ *d.* $4\frac{1}{2} \times 20$

e. $12 \times 1\frac{1}{4}$ *f.* $2\frac{1}{4} \times 12$ *g.* $12 \times 3\frac{1}{4}$ *h.* $4\frac{1}{4} \times 12$

i. $30 \times 1\frac{1}{3}$ *j.* $2\frac{1}{3} \times 30$ *k.* $30 \times 3\frac{1}{3}$ *l.* $4\frac{1}{3} \times 30$

m. $10 \times 1\frac{1}{5}$ *n.* $2\frac{1}{5} \times 10$ *o.* $10 \times 3\frac{1}{5}$ *p.* $4\frac{1}{5} \times 10$

Written Exercises

1. At the rate of 68 bushels per acre, how many bushels of corn would $23\frac{1}{4}$ acres yield?

PROCESS	
68 bu.	Multiply 68 by $\frac{1}{4}$. Do this by dividing
$23\frac{1}{4}$	68 by 4, writing each quotient figure in its
$\overline{17}$	proper place. Multiply 68 by 3 (ones), plac-
	ing the right-hand figure in the ones' column.
204	Place the right-hand figure of the product
$\underline{136}$	by 2 (tens) in the tens' column. Combine the
$\overline{1581}$ bu. *Ans.*	three partial products. Test the result by
	dividing 1581 by 68. The quotient should
be 68 and the remainder 17.	

2. Find products:

a. 68	*b.* 64	*c.* 128	*d.* 256	*e.* 92
× 14¼	× 23¼	× 34¼	× 42¼	× 53¼

f. 64	*g.* 126	*h.* 168	*i.* 240	*j.* 210
× 23½	× 34⅓	× 25⅓	× 32⅕	× 44⅛

3. Find the cost of 32 acres of land at \$124½ per acre.

\$124½
 32
———
 16
248
372
———
\$3984 *Ans.*

PROCESS

Find 32 times ½. Do this by dividing 32 by 2, writing each quotient figure in its proper place. Multiply 124 by 2 (ones). Then by 3 (tens). Combine the partial product.

TEST

Test the result by multiplying 124½ by 8, and the resulting product by 4.

124½
× 8
———
996
 4
———
3984

---

4. Multiply:

a. 168½	*b.* 206¼	*c.* 153⅓	*d.* 221⅕
× 24	× 52	× 39	× 65

e. 118½	*f.* 243⅛	*g.* 164¼	*h.* 342⅙
× 72	× 96	× 85	× 96

i. 123⅓	*j.* 225¼	*k.* 215½	*l.* 323⅓
× 84	× 68	× 32	× 24

Division — Fraction in Quotient

Sight Exercises

1. A farmer paid $42 for 4 calves. What did they cost apiece?

PROCESS

4)$42
‾‾‾‾‾‾
10\frac{2}{4}$ = 10\frac{1}{2}$ *Ans.*

Reduce $\frac{2}{4}$ in the quotient to $\frac{1}{2}$.

---

2. What is the cost of a chicken at the rate of $27 for 36 chickens?

PROCESS

36)$27
‾‾‾‾‾‾
$\frac{27}{36}$ = $\frac{3}{4}$ *Ans.*

Reduce the quotient $\frac{27}{36}$ to $\frac{3}{4}$.

---

3. Divide. Express fractions in quotients in lowest terms:

a. 2)9 *b.* 4)2 *c.* 2)15 *d.* 10)2 *e.* 4)30 *f.* 2)1

g. 4)9 *h.* 4)3 *i.* 4)15 *j.* 10)4 *k.* 6)20 *l.* 8)2

m. 6)9 *n.* 6)2 *o.* 6)15 *p.* 10)5 *q.* 3)20 *r.* 6)4

s. 8)9 *t.* 6)3 *u.* 8)15 *v.* 10)6 *w.* 8)20 *x.* 8)6

4. Give quotients:

a. $\frac{10}{4}$ *b.* $\frac{10}{15}$ *c.* $\frac{10}{3}$ *d.* $\frac{10}{16}$ *e.* $\frac{10}{6}$ *f.* $\frac{10}{25}$ *g.* $\frac{10}{24}$

h. $\frac{14}{4}$ *i.* $\frac{12}{15}$ *j.* $\frac{20}{3}$ *k.* $\frac{12}{16}$ *l.* $\frac{40}{3}$ *m.* $\frac{25}{40}$ *n.* $\frac{60}{40}$

5. Divide:

a. 18 ÷ 4 *b.* 4 ÷ 18 *c.* 18 ÷ 10 *d.* 10 ÷ 18 *e.* 14 ÷ 6

f. 30 ÷ 8 *g.* 8 ÷ 20 *h.* 25 ÷ 10 *i.* 10 ÷ 25 *j.* 10 ÷ 4

Written Exercises

1. A farmer paid $600 for 32 calves. How much did they cost apiece?

PROCESS

$\$\ 18\frac{24}{32} = \$18\frac{3}{4}$ *Ans.*

$32\overline{)\$600}$

$\quad\ \ \underline{32}$

$\quad\ \ 280$

$\quad\ \ \underline{256}$

$\quad\ \ \ 24$

Divide $600 by 32. Reduce $\frac{24}{32}$, the fraction in the quotient, to $\frac{3}{4}$.

Test by multiplying $18\frac{3}{4}$ (the quotient) by 32 (the divisor).

2. Divide :

Ans. ?	*Ans.* ?	*Ans.* ?	*Ans.* ?
a. $24\overline{)280}$	*b.* $16\overline{)200}$	*c.* $32\overline{)900}$	*d.* $36\overline{)570}$

3. At $32 each, how many cows can be bought for $500 and how many dollars will remain?

Fraction in Dividend

Sight Exercises

1. A man divided 3 quarters of a dollar among 3 boys. What part of a dollar did each receive?

2. Divide:

a. $3\overline{)3\ \text{quarters}}$ *b.* $\frac{3}{4} \div 3$ *c.* $2\overline{)2\ \text{thirds}}$ *d.* $\frac{2}{3} \div 2$

3. Give quotients:

a. $2\overline{)20\frac{2}{3}}$ *b.* $3\overline{)30\frac{3}{4}}$ *c.* $4\overline{)40\frac{4}{5}}$ *d.* $5\overline{)50\frac{5}{6}}$

e. $6\overline{)60\frac{6}{7}}$ *f.* $2\overline{)20\frac{4}{5}}$ *g.* $3\overline{)30\frac{9}{10}}$ *h.* $4\overline{)40\frac{8}{9}}$

Sight Problems

1. A's farm is $2\frac{1}{2}$ times as large as B's. B's contains 80 acres. How many acres are there (*a*) in A's farm? (*b*) In both farms?

2. How many square rods are there in a rectangular field $20\frac{1}{4}$ rods long, 12 rods wide?

(Diagram: rectangle labeled $20\frac{1}{4}$ rd. on top, 12 rd. on side)

3. X has $\frac{1}{2}$ as many sheep as Y; Y has $\frac{1}{5}$ as many as Z; X has 30 sheep. (*a*) How many has Y? (*b*) How many has Z?

4. After filling four $2\frac{1}{2}$ gallon cans with oil from a barrel, there are 35 gallons left in the latter. How many gallons were there in it at first?

5. One pipe discharges 10 gallons in $\frac{1}{2}$ minute, the other 10 gallons in $\frac{1}{3}$ minute. How many gallons per minute do both discharge together?

6. How many times does a clock tick in $2\frac{1}{2}$ minutes when it ticks 60 times a minute?

7. At the rate of 40 miles per hour, how far will a train go from a quarter to 1 to a quarter past 3?

8. A man bought a plow for $\$8\frac{1}{2}$ and paid $\$1\frac{1}{4}$ for repairs. If he sold it for $\$12$, what was his profit?

9. A train due at 9.20 A.M. arrived at 10 A.M. What part of an hour was it behind time?

10. What change should a person receive who gives a dollar bill to pay for $1\frac{1}{2}$ pounds of 40-cent tea?

11. I bought a half yard of cloth and gave the storekeeper $\$1$. If I received 40 cents in change, what did the cloth cost per yard?

12. A 12-acre field was divided into 32 plots of the same size. What part of an acre did each plot contain?

Written Problems

1. M's farm is $1\frac{3}{4}$ times as large as N's. N's contains 160 acres. How many acres are there (*a*) in M's farm? (*b*) In both farms?

2. How many square rods are there in a rectangular field $20\frac{3}{4}$ rods long, 16 rods wide?

3. One field contains 36 acres. Another field is $\frac{3}{4}$ as large. Find the number of acres in the two fields.

4. A has 36 sheep. He has $\frac{1}{2}$ as many as Y. (*a*) How many has Y? Y has $\frac{1}{3}$ as many as Z. (*b*) How many has Z?

5. After filling five $2\frac{1}{2}$-gallon cans with oil from a barrel there are $32\frac{1}{4}$ gallons left in the barrel. How many gallons were there in it at first?

6. One pipe discharges $13\frac{1}{4}$ gallons in $\frac{1}{2}$ minute, another discharges $10\frac{1}{3}$ gallons in $\frac{1}{3}$ minute. How many gallons per minute do both together discharge?

7. At the rate of 26 miles per hour, how far will a train go from a quarter to 1 to 3 o'clock?

8. A man bought a machine for $\$25\frac{3}{4}$, and spent $\$5\frac{1}{2}$ for repairs. If he sold it for $\$34\frac{1}{2}$, what was his profit?

9. A train due at 9.36 A.M. arrived at 10 A.M. What part of an hour was it late?

10. What change should a person receive who gives a dollar to pay for $1\frac{3}{4}$ pounds of 28-cent coffee?

11. I bought 3 yards of cloth and received $\$\frac{3}{4}$ change out of $\$3$. What part of a dollar did the cloth cost per yard?

12. How many acres does each plot contain when a farm of 160 acres is divided into (*a*) 128 equal plots? (*b*) 256 plots?

SECTION II

MIXED NUMBERS, TWO–PLACE DECIMALS, BILLS, DENOMINATE NUMBERS, MEASUREMENTS, SHORT METHODS, REVIEWS

Adding Mixed Numbers

Written Exercises

1. A boy walked a mile in $13\frac{3}{4}$ minutes and a second mile in $14\frac{7}{12}$ minutes. How long did it take him to walk two miles?

PROCESS

$$
\begin{array}{r}
12 \\
13\frac{3}{4} \quad \overline{9} \\
14\frac{7}{12} \quad \overline{7} \\
\hline
28\frac{1}{3} \quad \dfrac{16}{12} = 1\frac{4}{12} = 1\frac{1}{3}
\end{array}
$$

Ans. $28\frac{1}{3}$ min.

Since 12 is a multiple of 4, write 12 as the least common denominator of $\frac{3}{4}$ and $\frac{7}{12}$. Change $\frac{3}{4}$ to $\frac{9}{12}$, and write 9 (the numerator) under the common denominator. Under 9 write 7 (the numerator of the other fraction). Add the numerators and write 16 (the result) over the common denominator, making the sum of the fractions $\frac{16}{12}$. Change this improper fraction to the mixed number $1\frac{4}{12}$, and rewrite it, reducing the fraction, the result being $1\frac{1}{3}$. Write $\frac{1}{3}$ under the original fractions, and carry 1 to the whole numbers.

2. Add:

a. $83\frac{3}{5}$	*b.* $74\frac{2}{3}$	*c.* $67\frac{5}{6}$	*d.* $58\frac{2}{3}$	*e.* $49\frac{3}{4}$
$+8\frac{7}{10}$	$+15\frac{11}{12}$	$+9\frac{7}{12}$	$+20\frac{5}{9}$	$+5\frac{7}{8}$

Sight Exercises

Give sums.   Express fractions in results in lowest terms:

a. $\frac{1}{2}$	*b.* $\frac{1}{2}$	*c.* $\frac{1}{3}$	*d.* $\frac{1}{3}$	*e.* $\frac{1}{4}$	*f.* $\frac{1}{5}$
$+\frac{1}{10}$	$+\frac{1}{12}$	$+\frac{1}{9}$	$+\frac{1}{12}$	$+\frac{1}{12}$	$+\frac{1}{10}$

g. $\frac{1}{6}$	*h.* $\frac{1}{8}$	*i.* $\frac{1}{3}$	*j.* $\frac{1}{5}$	*k.* $\frac{1}{4}$	*l.* $\frac{1}{6}$
$+\frac{1}{12}$	$+\frac{1}{16}$	$+\frac{1}{15}$	$+\frac{1}{15}$	$+\frac{1}{16}$	$+\frac{1}{18}$

Written Exercises

1. On a piece of work one man spent $12\frac{4}{5}$ hours and another man spent $43\frac{3}{4}$ hours.   How many hours were spent by both?

PROCESS

$$\begin{array}{l} 12\frac{4}{5} \\ 43\frac{3}{4} \\ \hline 56\frac{11}{20} \end{array} \quad \begin{array}{|l} 20 \\ \hline 16 \\ 15 \\ \hline 31 \\ \hline 20 \end{array} = 1\frac{11}{20}$$

Since 5 and 4 have no common factor, write their product, 20, as the least common denominator, etc.

Ans. $56\frac{11}{20}$ hr.

NOTE.— Two numbers that have no common factor are said to be *prime to each other.*

2. Add:

a. $25\frac{4}{5}$	*b.* $18\frac{2}{3}$	*c.* $39\frac{5}{8}$	*d.* $48\frac{5}{6}$	*e.* $57\frac{3}{4}$
$+37\frac{1}{2}$	$+40\frac{2}{5}$	$+27\frac{2}{3}$	$+16\frac{5}{8}$	$+8\frac{4}{9}$

Sight Exercises

Give sums:

a. $\frac{1}{2}$	*b.* $\frac{1}{2}$	*c.* $\frac{1}{2}$	*d.* $\frac{1}{3}$	*e.* $\frac{1}{3}$	*f.* $\frac{1}{4}$
$+\frac{1}{3}$	$+\frac{1}{5}$	$+\frac{1}{9}$	$+\frac{1}{4}$	$+\frac{1}{5}$	$+\frac{1}{5}$

g. $\frac{1}{5}$	*h.* $\frac{1}{4}$	*i.* $\frac{1}{3}$	*j.* $\frac{1}{3}$	*k.* $\frac{1}{5}$	*l.* $\frac{1}{5}$
$+\frac{1}{6}$	$+\frac{1}{9}$	$+\frac{1}{8}$	$+\frac{1}{10}$	$+\frac{1}{9}$	$+\frac{1}{8}$

Written Exercises

1. A dealer sold two pieces of cloth, one containing $28\frac{5}{9}$ yards, and the other $8\frac{7}{12}$ yards. How many yards were there in both?

PROCESS

$$
\begin{array}{r}
36 \\
28\frac{5}{9} \quad \overline{20} \\
8\frac{7}{12} \quad \overline{21} \\
\hline
37\frac{5}{36} \quad \frac{41}{36} = 1\frac{5}{36}
\end{array}
$$

Since the denominators 9 and 12 have a common factor, test successive multiples of 12 (24, 36); since 36 is also a multiple of 9, write 36 as the common denominator.

Ans. $37\frac{5}{36}$ yd.

---

2. Add :

a. $24\frac{5}{6}$ *b.* $36\frac{3}{4}$ *c.* $47\frac{3}{4}$ *d.* $56\frac{5}{6}$ *e.* $63\frac{5}{8}$

$+9\frac{3}{8}$ $+19\frac{5}{6}$ $+8\frac{7}{10}$ $+18\frac{4}{9}$ $+7\frac{9}{10}$

Sight Exercises

1. Give sums :

a. $\frac{1}{4}$ *b.* $\frac{1}{4}$ *c.* $\frac{1}{6}$ *d.* $\frac{1}{6}$ *e.* $\frac{1}{6}$ *f.* $\frac{1}{8}$

$+\frac{1}{6}$ $+\frac{1}{10}$ $+\frac{1}{8}$ $+\frac{1}{9}$ $+\frac{1}{10}$ $+\frac{1}{12}$

g. $\frac{1}{9}$ *h.* $\frac{1}{10}$ *i.* $\frac{1}{8}$ *j.* $\frac{1}{6}$ *k.* $\frac{1}{10}$ *l.* $\frac{1}{15}$

$+\frac{1}{12}$ $+\frac{1}{12}$ $+\frac{1}{10}$ $+\frac{1}{15}$ $+\frac{1}{15}$ $+\frac{1}{20}$

2. Give remainders in lowest terms :

a. $\frac{1}{2}$ *b.* $\frac{1}{2}$ *c.* $\frac{1}{3}$ *d.* $\frac{1}{3}$ *e.* $\frac{1}{4}$ *f.* $\frac{1}{5}$

$-\frac{1}{10}$ $-\frac{1}{12}$ $-\frac{1}{9}$ $-\frac{1}{12}$ $-\frac{1}{12}$ $-\frac{1}{10}$

g. $\frac{1}{6}$ *h.* $\frac{1}{8}$ *i.* $\frac{1}{2}$ *j.* $\frac{1}{2}$ *k.* $\frac{1}{2}$ *l.* $\frac{1}{3}$

$-\frac{1}{12}$ $-\frac{1}{16}$ $-\frac{1}{3}$ $-\frac{1}{5}$ $-\frac{1}{9}$ $-\frac{1}{4}$

m. $\frac{1}{3}$ *n.* $\frac{1}{4}$ *o.* $\frac{1}{5}$ *p.* $\frac{1}{4}$ *q.* $\frac{1}{4}$ *r.* $\frac{1}{4}$

$-\frac{1}{5}$ $-\frac{1}{5}$ $-\frac{1}{6}$ $-\frac{1}{9}$ $-\frac{1}{6}$ $-\frac{1}{10}$

Subtracting Mixed Numbers

1. In making a trip of $30\frac{5}{6}$ miles, how far has a man to go after he has traveled (a) $12\frac{7}{12}$ miles? (b) $9\frac{3}{5}$ miles? (c) $16\frac{4}{9}$ miles?

PROCESS

	12			30			18
a. $30\frac{5}{6}$	10	b. $30\frac{5}{6}$	25	c. $30\frac{5}{6}$	15		
$-12\frac{7}{12}$	7	$-9\frac{3}{5}$	18	$-16\frac{4}{9}$	8		
$18\frac{1}{4}$	$\frac{3}{12}=\frac{1}{4}$	$21\frac{7}{30}$	$\frac{7}{30}$	$14\frac{7}{18}$	$\frac{7}{18}$		

Ans. $18\frac{1}{4}$ mi.   *Ans.* $21\frac{7}{30}$ mi.   *Ans.* $14\frac{7}{18}$ mi.

Find the common denominator. Write the new numerators. Subtract the numerators and place the remainder over the common denominator. Reduce this fraction to its lowest terms. Write it under the original fractions. Subtract the whole numbers.

2. Subtract:

a. $23\frac{3}{4}$ b. $31\frac{1}{4}$ c. $40\frac{2}{3}$ d. $52\frac{2}{3}$ e. $63\frac{5}{6}$
 $-14\frac{7}{12}$ $-8\frac{3}{10}$ $-15\frac{5}{12}$ $-9\frac{1}{9}$ $-18\frac{7}{12}$

Addition

1. Add the following: (a) $1\frac{1}{2}$ hours, $2\frac{2}{3}$ hours, $3\frac{3}{5}$ hours; (b) $1\frac{1}{4}$ minutes, $2\frac{5}{6}$ minutes, $3\frac{3}{10}$ minutes.

PROCESS

a. 30

$1\frac{1}{2}$ | 15
$2\frac{2}{3}$ | 20
$3\frac{3}{5}$ | 18
$7\frac{23}{30}$ | $\frac{53}{30}=1\frac{23}{30}$.

Ans. $7\frac{23}{30}$ hr.

a. Since 2, 3, and 5 are prime to each other, take their continued product, 30 ($2 \times 3 \times 5$), as the L. C. D. b. Find the L. C. M. of 4 and 6 (which is 12). Find the L. C. M. of 12 and 10, testing 24, 36, 48, 60 (multiples of 12); 60 is the L. C. D.

b. 60

$1\frac{1}{4}$ | 15
$2\frac{5}{6}$ | 50
$3\frac{3}{10}$ | 18
$7\frac{23}{60}$ | $\frac{83}{60}=1\frac{23}{60}$.

Ans. $7\frac{23}{60}$ min.

Written Exercises

2. Find sums :

a. $6\frac{1}{2}$	*b.* $10\frac{1}{3}$	*c.* $18\frac{3}{4}$	*d.* $23\frac{2}{3}$	*e.* $18\frac{3}{4}$
$20\frac{2}{8}$	$20\frac{3}{4}$	$26\frac{2}{5}$	$14\frac{5}{6}$	$24\frac{1}{6}$
$12\frac{1}{4}$	$6\frac{2}{5}$	$5\frac{1}{6}$	$8\frac{1}{9}$	$16\frac{5}{9}$

f. $36\frac{2}{5}$	*g.* $6\frac{1}{3}$	*h.* $6\frac{1}{3}$	*i.* $17\frac{7}{8}$	*j.* $38\frac{1}{4}$
$7\frac{3}{10}$	$21\frac{5}{6}$	$21\frac{5}{6}$	$6\frac{1}{2}$	$6\frac{4}{5}$
$33\frac{1}{2}$	$13\frac{2}{9}$	$3\frac{2}{9}$	$32\frac{7}{10}$	$\frac{7}{10}$

3. Add the following : (*a*) $1\frac{1}{2}$ years, $2\frac{2}{3}$ years, $3\frac{1}{4}$ years, $4\frac{5}{12}$ years ; (*b*) $1\frac{2}{3}$ days, $2\frac{3}{4}$ days, $3\frac{1}{6}$ days, $4\frac{3}{8}$ days.

PROCESS

a.
$$\begin{array}{r|l} & 12 \\ \hline 1\frac{1}{2} & 6 \\ 2\frac{2}{3} & 8 \\ 3\frac{1}{4} & 3 \\ 4\frac{5}{12} & 5 \\ \hline 11\frac{5}{6} & \overline{22} \\ & 12 \end{array} = 1\frac{10}{12} = 1\frac{5}{6}$$

Ans. $11\frac{5}{6}$ yr.

b.
$$\begin{array}{r|l} & 24 \\ \hline 1\frac{2}{3} & 16 \\ 2\frac{3}{4} & 18 \\ 3\frac{1}{6} & 4 \\ 4\frac{3}{8} & 9 \\ \hline 11\frac{23}{24} & \overline{47} \\ & 24 \end{array} = 1\frac{23}{24}$$

Ans. $11\frac{23}{24}$ da.

a. Reject 2, 3, 4.   *b.* Reject 3 and 4.   Find L. C. M. of 6 and 8.

---

4. Find sums :

a. $6\frac{1}{2}$	*b.* $10\frac{1}{3}$	*c.* $5\frac{1}{6}$	*d.* $18\frac{1}{2}$	*e.* $36\frac{3}{10}$
$20\frac{2}{8}$	$6\frac{1}{2}$	$23\frac{2}{3}$	$24\frac{1}{4}$	$7\frac{1}{6}$
$12\frac{3}{4}$	$18\frac{1}{4}$	$14\frac{5}{12}$	$9\frac{2}{5}$	$33\frac{1}{2}$
$8\frac{1}{6}$	$26\frac{5}{8}$	$8\frac{1}{4}$	$16\frac{3}{8}$	$6\frac{4}{5}$

f. $21\frac{1}{3}$	*g.* $32\frac{8}{9}$	*h.* $38\frac{3}{10}$	*i.* $7\frac{1}{2}$	*j.* $12\frac{7}{10}$
$13\frac{9}{10}$	$27\frac{2}{3}$	$6\frac{2}{5}$	$10\frac{1}{4}$	$6\frac{3}{8}$
$17\frac{1}{2}$	$11\frac{1}{6}$	$\frac{5}{6}$	$18\frac{5}{6}$	$17\frac{3}{4}$
$6\frac{2}{5}$	$1\frac{1}{2}$	$14\frac{1}{3}$	$23\frac{7}{8}$	$7\frac{1}{2}$

Subtraction

Preparatory Exercises

1. Give missing addend :

a. $\frac{2}{5}$	*b.* $\frac{2}{5}$	*c.* $\frac{3}{5}$	*d.* $\frac{4}{5}$	*e.* $\frac{3}{5}$	*f.* $\frac{4}{5}$
$+\,?$	$+\,?$	$+\,?$	$+\,?$	$+\,?$	$+\,?$
1	$1\frac{1}{5}$	$1\frac{1}{5}$	$1\frac{1}{5}$	$1\frac{2}{5}$	$1\frac{2}{5}$

g. $\frac{4}{5}$	*h.* $\frac{2}{3}$	*i.* $\frac{5}{6}$	*j.* $\frac{4}{9}$	*k.* $\frac{7}{9}$	*l.* $\frac{7}{9}$
$+\,?$	$+\,?$	$+\,?$	$+\,?$	$+\,?$	$+\,?$
$1\frac{3}{5}$	$1\frac{1}{3}$	$1\frac{1}{9}$	$1\frac{2}{9}$	$1\frac{5}{9}$	$1\frac{1}{9}$

2. Subtract :

a. 1	*b.* $1\frac{1}{5}$	*c.* $1\frac{1}{5}$	*d.* $1\frac{1}{5}$	*e.* $1\frac{2}{5}$	*f.* $1\frac{2}{5}$
$-\frac{2}{5}$	$-\frac{2}{5}$	$-\frac{3}{5}$	$-\frac{4}{5}$	$-\frac{3}{5}$	$-\frac{4}{5}$

g. $1\frac{3}{5}$	*h.* $1\frac{1}{3}$	*i.* $1\frac{1}{9}$	*j.* $1\frac{2}{9}$	*k.* $1\frac{5}{9}$	*l.* $1\frac{1}{9}$
$-\frac{4}{5}$	$-\frac{2}{3}$	$-\frac{5}{9}$	$-\frac{5}{9}$	$-\frac{7}{9}$	$-\frac{7}{9}$

Written Exercises

1. From $60\frac{7}{24}$ days, take (*a*) $30\frac{11}{24}$ days; (*b*) $28\frac{13}{24}$ days; (*c*) $7\frac{23}{24}$ days.

PROCESS

a. $60\frac{7}{24}$ $\quad$ (31) $\qquad$ *b.* $60\frac{7}{24}$ $\quad$ (31) $\qquad$ *c.* $60\frac{7}{24}$ $\quad$ (31)

$\ 30\frac{11}{24}$ $\qquad\qquad\ \ 28\frac{13}{24}$ $\qquad\qquad\ \ \ 7\frac{23}{24}$

$\ \overline{29\frac{5}{6}}\ \Big|\ \frac{20}{24}=\frac{5}{6}$ $\qquad \overline{31\frac{3}{4}}\ \Big|\ \frac{18}{24}=\frac{3}{4}$ $\qquad \overline{52\frac{1}{3}}\ \Big|\ \frac{8}{24}=\frac{1}{3}$

Ans. $29\frac{5}{6}$ da. $\qquad$ *Ans.* $31\frac{3}{4}$ da. $\qquad$ *Ans.* $52\frac{1}{3}$ da.

The fraction in the subtrahend being greater in each case than the fraction in the minuend, increase the latter fraction by 1, making it $1\frac{7}{24}$, which equals $\frac{31}{24}$. Write 31 in a parenthesis.

In (*a*) think $\frac{11}{24}$ and $\frac{20}{24}$ (writing $\frac{20}{24}$) are $\frac{31}{24}$. Reduce $\frac{20}{24}$ to $\frac{5}{6}$ and write the latter under the original fractions. Carry 1 to the whole number in the subtrahend.

---

2. Subtract:

a. $90\frac{1}{4}$	*b.* $81\frac{3}{8}$	*c.* $72\frac{5}{12}$	*d.* $63\frac{3}{16}$	*e.* $54\frac{2}{9}$
$-\ 8\frac{3}{4}$	$-\ 17\frac{7}{8}$	$-\ 25\frac{11}{12}$	$-\ 34\frac{9}{16}$	$-\ 9\frac{7}{9}$

f. $45\frac{2}{5}$	*g.* $36\frac{1}{3}$	*h.* $27\frac{11}{20}$	*i.* $30\frac{3}{10}$	*j.* $44\frac{1}{6}$
$-\ 16\frac{4}{5}$	$-\ 27\frac{2}{3}$	$-\ 8\frac{19}{20}$	$-\ 10\frac{9}{10}$	$-\ 25\frac{5}{6}$

3. From $60\frac{1}{6}$ miles, take (*a*) $12\frac{5}{12}$ miles, (*b*) $9\frac{3}{5}$ miles, (*c*) $26\frac{8}{9}$ miles.

PROCESS

$$\overset{12}{}\qquad\qquad\overset{30}{}\qquad\qquad\overset{18}{}$$

a. $60\frac{1}{6}\ \bigg|\ \overline{2}\ (14)$ *b.* $60\frac{1}{6}\ \bigg|\ \overline{5}\ (35)$ *c.* $60\frac{1}{6}\ \bigg|\ \overline{3}\ (21)$

$-12\frac{5}{12}\ \bigg|\ 5$ $-\ 9\frac{3}{5}\ \bigg|\ 18$ $-26\frac{8}{9}\ \bigg|\ 16$

$\overline{47\frac{3}{4}}\ \bigg|\ \frac{9}{12}=\frac{3}{4}$ $\overline{50\frac{17}{30}}\ \bigg|\ \frac{17}{30}$ $\overline{33\frac{5}{18}}\ \bigg|\ \frac{5}{18}$

Ans. $47\frac{3}{4}$ mi.   *Ans.* $50\frac{17}{30}$ mi.   *Ans.* $33\frac{5}{18}$ mi.

a. Write 12 (the L. C. D.). Write the new numerators. Since 5 twelfths is greater than 2 twelfths, increase the latter by 1, making $1\frac{2}{12}$, which is equal to $\frac{14}{12}$. Write 14 in a parenthesis. Think $\frac{5}{12}$ and $\frac{9}{12}$ (writing $\frac{9}{12}$) are $\frac{14}{12}$. Change $\frac{9}{12}$ to $\frac{3}{4}$, and write $\frac{3}{4}$ under the original fractions. Carry 1 to 2, and think 3 and 7 (writing 7) are 10; etc.

b. Increase 5 thirtieths by 1, making $\frac{35}{30}$. Write 35 in a parenthesis, etc.

c. Increase 3 eighteenths by 1; etc.

---

4. Find remainders:

a. $23\frac{7}{12}$	*b.* $31\frac{3}{10}$	*c.* $40\frac{5}{12}$	*d.* $52\frac{1}{9}$	*e.* $63\frac{5}{6}$
$-\ 5\frac{3}{4}$	$-\ 16\frac{4}{5}$	$-\ 5\frac{2}{3}$	$-\ 16\frac{2}{3}$	$-\ 8\frac{7}{12}$

f. $56\frac{3}{8}$	*g.* $46\frac{1}{6}$	*h.* $36\frac{3}{10}$	*i.* $24\frac{4}{9}$	*j.* $49\frac{5}{8}$
$-\ 28\frac{5}{6}$	$-\ 8\frac{3}{4}$	$-\ 19\frac{3}{4}$	$-\ 5\frac{5}{6}$	$-\ 29\frac{9}{10}$

Sight Problems

1. A church roof is 40 feet from the ground. The steeple extends 25½ feet above the roof. How high above the ground is the top of the steeple?

2. M has $3½; N has $1¼ more than M. *a.* How much money has N? *b.* How much money have both?

3. After selling 3½ tons of hay a farmer still has 20⅝ tons. How many tons had he originally?

4. How many acres are there in two fields, one of which contains 20½ acres, and the other 3¼ acres less?

5. What is the perimeter of a rectangle 10½ feet long, 6¼ feet wide?

6. How much change should I receive if I buy goods amounting to $10½ and I give the grocer a $20-bill?

Written Problems

1. The deck of a vessel is 34⅝ feet above the surface of the water, and the top of a mast is 67¾ feet above the deck. How high above the water is the top of the mast?

2. A has $32½; B has $7¾ more than A. How much have both together?

3. After selling 13 8⁄25 tons of hay a farmer has 28 7⁄10 tons remaining. How many tons had he at first?

4. How much land is there in two fields, one of which contains 28⅞ acres, and the other 9⅚ acres less?

5. How many feet are there in the four sides of a rectangle 39¾ feet wide and 87¾ feet long? How many feet and inches?

6. With a $50-bill I pay for three articles costing, respectively, $12¾, $ 8⁄10, $8 17⁄25. How much change should I receive?

Multiplication — One Factor a Whole Number

Preparatory Exercises

1. Multiply :

a. 2 sevenths   *b.* 2 ninths   *c.* 1 tenth   *d.* 1 third

    $\times\,3$ $\times\,4$ $\times\,7$ $\times\,2$

e. $4 \times \frac{2}{9}$ *f.* $7 \times \frac{1}{12}$ *g.* $3 \times \frac{1}{4}$ *h.* $2 \times \frac{2}{5}$

2. Give products in lowest terms :

a. $3 \times \frac{1}{6}$ *b.* $4 \times \frac{1}{8}$ *c.* $2 \times \frac{1}{10}$ *d.* $3 \times \frac{1}{9}$

e. $4 \times \frac{1}{12}$ *f.* $2 \times \frac{1}{16}$ *g.* $3 \times \frac{1}{12}$ *h.* $4 \times \frac{1}{16}$

NOTE. — The expressions $10 \times \frac{1}{5}$, $\frac{1}{5} \times 10$, and $\frac{1}{5}$ of 10 indicate the same operation, the result in each case being 2.

3. Multiply :

a. $5 \times \frac{1}{6}$ *b.* $6 \times \frac{5}{6}$ *c.* $5 \times \frac{1}{3}$ *d.* $12 \times \frac{1}{4}$

e. $5 \times \frac{1}{5}$ *f.* $4 \times \frac{3}{4}$ *g.* $6 \times \frac{2}{3}$ *h.* $12 \times \frac{5}{6}$

i. $7 \times \frac{1}{8}$ *j.* $8 \times \frac{5}{8}$ *k.* $8 \times \frac{1}{4}$ *l.* $15 \times \frac{2}{3}$

m. $7 \times \frac{1}{7}$ *n.* $9 \times \frac{7}{9}$ *o.* $8 \times \frac{3}{4}$ *p.* $10 \times \frac{4}{5}$

q. $8 \times \frac{1}{9}$ *r.* $7 \times \frac{5}{7}$ *s.* $9 \times \frac{1}{3}$ *t.* $10 \times \frac{1}{5}$

u. $8 \times \frac{1}{8}$ *v.* $5 \times \frac{3}{5}$ *w.* $9 \times \frac{2}{3}$ *x.* $10 \times \frac{3}{5}$

Sight Exercises

1. Multiply by 10 : *a.* $\frac{1}{2}$.   *b.* $\frac{1}{3}$.   *c.* $\frac{3}{4}$.   *d.* $\frac{3}{5}$.   *e.* $\frac{4}{5}$. *f.* $\frac{1}{6}$.   *g.* $\frac{5}{6}$.   *h.* $\frac{1}{8}$.

2. Multiply by 12 : *a.* $\frac{1}{2}$.   *b.* $\frac{2}{3}$.   *c.* $\frac{1}{4}$.   *d.* $\frac{5}{6}$.   *e.* $\frac{2}{3}$. *f.* $\frac{3}{8}$.   *g.* $\frac{1}{3}$.   *h.* $\frac{2}{3}$.

3. Multiply by 24 : *a.* $1\frac{1}{2}$.   *b.* $1\frac{1}{3}$.   *c.* $1\frac{1}{4}$.   *d.* $1\frac{2}{3}$. *e.* $1\frac{3}{4}$.   *f.* $1\frac{1}{6}$.   *g.* $1\frac{5}{6}$.

4. Multiply by $2\frac{1}{4}$: *a.* 4.   *b.* 8.   *c.* 12.   *d.* 16. *e.* 20.   *f.* 24.   *g.* 28.   *h.* 32.

Written Exercises

1. How many inches of wire will be required to make
408 tacks if $\frac{7}{16}$ of an inch is required for each tack?

	PROCESS	
51		Write 408 as an
$\frac{\cancel{408}}{1} \times \frac{7 \text{ in.}}{\cancel{16}} = \frac{357 \text{ in.}}{2} = 178\frac{1}{2} \text{ in.}$ ***Ans.***		improper fraction with 1 for the denominator. Cancel.
2		

2. Find products:

a. $864 \times \frac{8}{9}$ *b.* $\frac{5}{6} \times 981$ *c.* $396 \times \frac{11}{24}$ *d.* $\frac{2}{15} \times 215$

e. $472 \times \frac{7}{8}$ *f.* $\frac{6}{7} \times 525$ *g.* $576 \times \frac{5}{18}$ *h.* $\frac{5}{12} \times 630$

i. $576 \times \frac{3}{4}$ *j.* $\frac{3}{5} \times 875$ *k.* $225 \times \frac{3}{10}$ *l.* $\frac{7}{20} \times 350$

3. How many square rods are there in a field (*a*) 127
rods long, $38\frac{1}{4}$ rods wide? (*b*) $127\frac{1}{4}$ rods long, 38 rods
wide?

	PROCESS	
	In (*a*) first write $31\frac{3}{4}$ (the product of 127 by $\frac{1}{4}$).	
a. 127	Next write 1016 (the product of 127 by 8). Then	*b.* $127\frac{1}{4}$
$38\frac{1}{4}$	write 381 tens (the product of 127 by 3 tens).	38
$31\frac{3}{4}$	Combine the three partial	$9\frac{1}{2}$
1016	products.	1016
381	In (*b*) first write $9\frac{1}{2}$	381
Ans. $4857\frac{3}{4}$	(the product of $\frac{1}{4}$ by 38).	*Ans.* $4835\frac{1}{2}$
(sq. rd.)	Then write the other two partial products. Combine.	(sq. rd.)

4. Find products:

a. $49 \times 16\frac{1}{3}$ *b.* $75 \times 45\frac{1}{6}$ *c.* $149\frac{1}{6} \times 63$

d. $58 \times 24\frac{1}{4}$ *e.* $86 \times 54\frac{1}{8}$ *f.* $204\frac{1}{4} \times 74$

g. $67 \times 32\frac{1}{6}$ *h.* $98 \times 36\frac{1}{3}$ *i.* $327\frac{1}{3} \times 85$

5. Find the cost of (*a*) 404 acres of land at \$24$\frac{3}{8}$ per acre; (*b*) 404$\frac{7}{9}$ acres at \$24 per acre.

PROCESS

a.   404

    \$ 24$\frac{3}{8}$

8)   1212

      151 ($\frac{4}{8}$)$\frac{1}{2}$

      1616

      808

  \$ 9847$\frac{1}{2}$ *Ans.*

In (*a*) find the product of 404 by $\frac{3}{8}$ by multiplying 404 by 3 and dividing the product by 8, expressing the fraction in lowest terms.

In (*b*) find the product of $\frac{7}{9}$ by 24 by multiplying 24 by 7 and dividing the product by 9, expressing the fraction in lowest terms.

b.   404$\frac{7}{9}$

    \$ 24

9)   168

      18 ($\frac{6}{9}$)$\frac{2}{3}$

      1616

      808

Ans.   \$ 9714$\frac{2}{3}$

6. Multiply:

a. $147 \times 96\frac{2}{3}$ *b.* $635\frac{8}{9} \times 75$ *c.* $234 \times 87\frac{3}{4}$

d. $328 \times 76\frac{2}{5}$ *e.* $727\frac{11}{12} \times 63$ *f.* $465 \times 63\frac{5}{6}$

g. $524 \times 58\frac{5}{8}$ *h.* $826\frac{5}{6} \times 36$ *i.* $816 \times 55\frac{7}{10}$

Drill Exercises

1. Count by 12ths from $\frac{1}{12}$ to 1, expressing each successive fraction in its lowest terms.

2. Count by 16ths from $\frac{1}{16}$ to 1.

3. Count by 8ths from $\frac{1}{8}$ to 2.

4. Count by 20ths.   **5.** By 24ths.   **6.** By 30ths.

Two Fractional Factors

Preparatory Exercises

1. What is *a.* $\frac{1}{2}$ of 8? *b.* $\frac{1}{2}$ of 4? *c.* $\frac{1}{2}$ of 2? *d.* $\frac{1}{2}$ of 1? *e.* $\frac{1}{2}$ of $\frac{1}{2}$? *f.* $\frac{1}{2}$ of $\frac{1}{3}$? *g.* $\frac{1}{3}$ of $\frac{1}{3}$?

2. What is *a.* $\frac{1}{2}$ of $\frac{2}{3}$? *b.* $\frac{1}{3}$ of $\frac{3}{4}$? *c.* $\frac{1}{2}$ of $\frac{4}{5}$? *d.* $\frac{1}{3}$ of $\frac{3}{5}$? *e.* $\frac{1}{3}$ of $\frac{3}{8}$? *f.* $\frac{1}{4}$ of $\frac{4}{5}$? *g.* $\frac{1}{5}$ of $\frac{5}{6}$?

3. What is *a.* $\frac{1}{2}$ of $\frac{2}{5}$? *b.* $\frac{2}{5}$ of $\frac{1}{2}$? *c.* $\frac{1}{3}$ of $\frac{2}{5}$? *d.* $\frac{2}{5}$ of $\frac{1}{3}$? *e.* $\frac{2}{3}$ of $\frac{2}{5}$? *f.* $\frac{2}{5}$ of $\frac{2}{3}$?

To multiply fractions, cancel, then write the product of their new numerators over the product of their new denominators.

Sight Exercises

1. Give products:

a. $\frac{1}{2} \times \frac{2}{3}$ *b.* $\frac{1}{3} \times \frac{3}{4}$ *c.* $\frac{3}{4} \times \frac{2}{3}$ *d.* $\frac{3}{4} \times \frac{5}{8}$

e. $\frac{1}{2} \times \frac{3}{4}$ *f.* $\frac{1}{3} \times \frac{2}{3}$ *g.* $\frac{4}{5} \times \frac{1}{2}$ *h.* $\frac{5}{6} \times \frac{1}{2}$

i. $\frac{1}{2} \times \frac{3}{5}$ *j.* $\frac{1}{3} \times \frac{4}{5}$ *k.* $\frac{5}{6} \times \frac{2}{5}$ *l.* $\frac{2}{3} \times \frac{7}{10}$

2. Multiply by $\frac{1}{2}$:   *a.* $\frac{1}{8}$.   *b.* $\frac{2}{3}$.   *c.* $\frac{3}{4}$.   *d.* $\frac{4}{5}$.   *e.* $\frac{1}{6}$. *f.* $\frac{5}{6}$.   *g.* $\frac{4}{5}$.

3. Multiply by $\frac{1}{3}$:   *a.* $\frac{1}{4}$.   *b.* $\frac{1}{2}$.   *c.* $\frac{1}{4}$.   *d.* $\frac{3}{4}$.   *e.* $\frac{5}{6}$. *f.* $\frac{1}{12}$.   *g.* $\frac{2}{9}$.

4. Multiply by $\frac{2}{3}$:   *a.* $\frac{1}{2}$.   *b.* $\frac{5}{6}$.   *c.* $\frac{3}{4}$.   *d.* $\frac{7}{8}$.   *e.* $\frac{1}{10}$. *f.* $\frac{5}{12}$.   *g.* $\frac{3}{8}$.

5. Multiply by $\frac{3}{4}$:   *a.* $\frac{1}{2}$.   *b.* $\frac{2}{3}$.   *c.* $\frac{4}{5}$.   *d.* $\frac{2}{5}$.   *e.* $\frac{5}{6}$. *f.* $\frac{7}{8}$.   *g.* $\frac{5}{9}$.

6. Multiply by $\frac{3}{10}$:   *a.* $\frac{1}{2}$.   *b.* $\frac{3}{4}$.   *c.* $\frac{1}{5}$.   *d.* $\frac{4}{5}$.   *e.* $\frac{1}{10}$. *f.* $\frac{5}{8}$.   *g.* $\frac{1}{5}$.

Written Exercises

1. How many cubic feet are there in a marble slab 12 feet long, $1\frac{2}{3}$ feet wide, $\frac{3}{4}$ foot thick?

PROCESS

$$12 \times 1\frac{2}{3} \times \frac{3}{4} = \frac{\overset{3}{\cancel{12}}}{1} \times \frac{5}{\cancel{3}} \times \frac{\cancel{3}}{\cancel{4}} = 15 \text{ (cu. ft.)} \quad Ans.$$

Change the whole and the mixed number to improper fractions. Cancel.

---

2. Multiply:

a. $\frac{2}{5} \times \frac{15}{16} \times 8$ *b.* $3\frac{3}{4} \times 4\frac{2}{5}$ *c.* $16\frac{2}{3} \times 6\frac{2}{5}$

d. $\frac{3}{4} \times \frac{9}{10} \times \frac{20}{27}$ *e.* $5\frac{1}{5} \times 7\frac{1}{12}$ *f.* $24\frac{1}{2} \times 5\frac{1}{4}$

g. $\frac{4}{5} \times \frac{1}{6} \times \frac{15}{28}$ *h.* $8\frac{1}{3} \times 3\frac{3}{10}$ *i.* $10\frac{1}{2} \times 1\frac{2}{7}$

j. $\frac{7}{8} \times \frac{3}{10} \times \frac{20}{21}$ *k.* $5\frac{1}{4} \times 1\frac{3}{7}$ *l.* $15\frac{2}{3} \times 6\frac{1}{10}$

m. $\frac{2}{3} \times \frac{7}{9} \times \frac{18}{35}$ *n.* $1\frac{3}{5} \times 3\frac{3}{4}$ *o.* $14\frac{1}{6} \times 2\frac{2}{15}$

Sight Exercises

1. Multiply:

a. $\frac{1}{2} \times \frac{10}{3}$ *b.* $\frac{1}{2} \times \frac{16}{3}$ *c.* $\frac{1}{2} \times \frac{20}{4}$ *d.* $\frac{1}{2} \times \frac{31}{3}$

e. $\frac{1}{2} \times 5\frac{1}{3}$ *f.* $\frac{1}{2} \times 7\frac{1}{4}$ *g.* $\frac{1}{3} \times 4\frac{1}{2}$ *h.* $\frac{1}{4} \times 7\frac{1}{5}$

i. $\frac{1}{3} \times 4\frac{1}{2}$ *j.* $\frac{1}{5} \times 6\frac{1}{4}$ *k.* $\frac{1}{4} \times 5\frac{1}{3}$ *l.* $\frac{1}{2} \times 8\frac{1}{4}$

m. $\frac{1}{4} \times 8\frac{4}{5}$ *n.* $\frac{1}{3} \times 9\frac{3}{4}$ *o.* $\frac{1}{2} \times 7\frac{1}{3}$ *p.* $\frac{1}{3} \times 6\frac{3}{4}$

First take the two factors whose product is a whole number, then multiply this product by the remaining factor.

q. $4 \times 2\frac{1}{2} \times 3\frac{1}{5}$ *r.* $12\frac{1}{2} \times 8 \times 1\frac{1}{25}$

s. $3\frac{1}{3} \times 1\frac{3}{10} \times 3$ *t.* $33\frac{1}{3} \times 1\frac{1}{4} \times 3$

u. $1\frac{1}{4} \times 4\frac{2}{5} \times 8$ *v.* $16\frac{2}{3} \times 6 \times 2\frac{1}{4}$

w. $2\frac{2}{3} \times 3 \times 1\frac{7}{8}$ *x.* $12\frac{1}{2} \times 1\frac{3}{10} \times 4$

y. $3\frac{1}{2} \times 1\frac{3}{7} \times 4$ *z.* $10\frac{1}{2} \times 2 \times 1\frac{1}{7}$

Sight Problems

1. How much will be left of $1 after paying for 8 pounds of sugar at 6¼ cents per pound?

2. A boy picked 5½ bushels of tomatoes in one week and 6½ the next week, which he sold for $¾ per bushel. How much did he receive for them?

3. How many cubic feet will a box contain, when its inside measurements are 3⅓ feet in length, 2¼ feet in width, and 3 feet in height?

4. A square rod is 5½ yards long and 5½ yards wide. How many square yards are there in a square rod?

5. How many inches of wire are required to make 4 dozen nails if each nail requires ⅞ inch?

6. A dealer sells three fourths of a 24-yard piece of cloth at $1½ per yard. What does he receive for the part sold?

7. How many bushels of apples will 16 barrels hold if each holds 2½ bushels?

8. A man buys 2 pigs at $10½ each. He pays $8¾ in cash and the remainder in hay. What is the value of the hay?

9. A girl has 2¼ yards of ribbon. How much has she after using two thirds of it?

10. If a train goes 10¼ miles in ¼ hour, how far does it go in ½ hour at the same rate?

11. At 5 miles per hour, how long will it take to drive 3⅜ miles beyond Goshen, which is 7½ miles away?

12. John earns ⅔ of a dollar and gave his brother ⅖ of it. What part of a dollar did John keep?

13. If it requires 1½ bushels of wheat to sow an acre, how many bushels will be required to sow 42 acres?

Written Problems

1. At $5\frac{7}{8}\cancel{c}$ per pound, how much less than $20 will be the cost of a barrel of sugar containing 312 pounds?

2. A man sold two loads of potatoes containing $47\frac{1}{2}$ and $34\frac{3}{4}$ bushels, respectively. How much did he receive for them at $$\frac{3}{5}$ per bushel?

3. How many cubic yards are removed in making an excavation $21\frac{1}{3}$ yards long, $10\frac{1}{2}$ yards wide, $2\frac{7}{8}$ yards deep?

4. A plot $16\frac{1}{2}$ feet long and $16\frac{1}{2}$ feet wide contains a square rod. How many square feet are there in a square rod?

5. How many feet of wire are required to make 8 dozen nails if each nail requires $1\frac{7}{8}$ inches of wire?

6. From a piece of cloth containing 40 yards a dealer sells $\frac{2}{5}$ of it at $$1\frac{1}{4}$ per yard, and $\frac{2}{3}$ of the remainder at $$1\frac{1}{2}$ per yard. How much is received for the two pieces sold?

7. At $16\frac{1}{2}$ feet to the rod, how many feet are there in $9\frac{1}{8}$ rods?

8. A man buys 3 pigs at $$10\frac{1}{2}$ apiece. He pays in cash $$23\frac{4}{5}$ and the rest in potatoes. What is the value of the potatoes?

9. A farmer has $272\frac{1}{4}$ acres of land, $\frac{5}{8}$ of which is cultivated. How many acres are cultivated?

10. If a train goes $10\frac{1}{4}$ miles in $\frac{1}{4}$ hour, how far does it go in $3\frac{1}{2}$ hours, at the same rate?

11. Mary earned $$10\frac{1}{2}$ and gave $\frac{2}{3}$ of it to her mother. How much did she keep?

12. If $1\frac{1}{4}$ bushels of wheat will sow an acre, how many bushels will it take to sow $43\frac{1}{5}$ acres?

Division of Fractions — Divisor a Whole Number

Preparatory Exercises

1. Give answers:

a. 3)6 sevenths   *b.* 4)8 ninths   *c.* 2)4 fifths

d. $\frac{8}{9} \div 2 = ?$ *e.* $\frac{9}{10} \div 3 = ?$ *f.* $\frac{4}{3} \div 2 = ?$

2. When $\frac{1}{2}$ of an apple is divided into 2 equal parts, what fraction of the apple is each part?

3. When $\frac{1}{2}$ a pie is divided into 3 equal parts, what fraction of the pie is each part?

To divide a fraction by a whole number, divide its numerator by the number, or multiply its denominator by the number.

Sight Exercises

1. Divide by 2:

a. $\frac{1}{2}$ *b.* $\frac{1}{3}$ *c.* $\frac{2}{3}$ *d.* $\frac{1}{4}$ *e.* $\frac{3}{4}$ *f.* $\frac{8}{2}$ *g.* $1\frac{1}{2}$

h. $\frac{2}{5}$ *i.* $\frac{6}{5}$ *j.* $\frac{3}{5}$ *k.* $\frac{1}{6}$ *l.* $\frac{5}{6}$ *m.* $\frac{4}{3}$ *n.* $1\frac{1}{3}$

2. Divide by 3:

a. $\frac{2}{3}$ *b.* $\frac{3}{4}$ *c.* $\frac{1}{5}$ *d.* $\frac{3}{5}$ *e.* $\frac{9}{10}$ *f.* $\frac{3}{2}$ *g.* $1\frac{1}{2}$

h. $\frac{3}{10}$ *i.* $\frac{2}{5}$ *j.* $\frac{1}{6}$ *k.* $\frac{5}{6}$ *l.* $\frac{4}{5}$ *m.* $\frac{4}{3}$ *n.* $1\frac{1}{3}$

3. Divide by 4:

a. $\frac{2}{3}$ *b.* $\frac{3}{4}$ *c.* $\frac{4}{5}$ *d.* $\frac{5}{6}$ *e.* $\frac{3}{10}$ *f.* $\frac{8}{3}$ *g.* $2\frac{2}{3}$

h. $\frac{2}{5}$ *i.* $\frac{1}{6}$ *j.* $\frac{1}{2}$ *k.* $\frac{1}{10}$ *l.* $\frac{8}{9}$ *m.* $\frac{3}{2}$ *n.* $1\frac{1}{2}$

4. Give quotients:

a. 2)$8\frac{1}{2}$ *b.* 2)$10\frac{1}{3}$ *c.* 2)$12\frac{2}{3}$ *d.* 2)$20\frac{1}{4}$

e. 3)$9\frac{1}{4}$ *f.* 3)$15\frac{3}{5}$ *g.* 3)$12\frac{1}{2}$ *h.* 3)$24\frac{1}{3}$

Written Exercises

1. How many acres would there be in each part of a farm of $435\frac{3}{4}$ acres, if it were divided (*a*) into 3 equal parts? (*b*) Into 4? (*c*) Into 5? (*d*) Into 6?

PROCESS

a. $3)\overline{435\frac{3}{4}}$ A.　　*a.* Divide $\frac{3}{4}$ (the remainder) by 3 by
Ans. $145\frac{1}{4}$ A.　　dividing the numerator.

b. $4)\overline{435\frac{3}{4}}$ A.　　*b.* Change the remainder $3\frac{3}{4}$ into $\frac{15}{4}$. Di-
Ans. $108\frac{15}{16}$ A.　　vide $\frac{15}{4}$ by 4 by multiplying the denominator.

c. $5)\overline{435\frac{3}{4}}$ A.　　*c.* Divide $\frac{3}{4}$ (the remainder) by 5 by
Ans. $87\frac{3}{20}$ A.　　multiplying the denominator.

d. $6)\overline{435\frac{3}{4}}$ A.　　*d.* Change $3\frac{3}{4}$ (the remainder) into $\frac{15}{4}$.
Ans. $72\frac{5}{8}$ A.　　Multiply the denominator by 6, which gives
$\frac{15}{24}$ for the quotient. Reduce it to $\frac{5}{8}$.

Test each quotient by multiplying it by the divisor.

---

2. Divide:

$a.\ 2)\overline{296\frac{2}{3}}$　　$b.\ 2)\overline{387\frac{1}{3}}$　　$c.\ 2)\overline{432\frac{1}{2}}$　　$d.\ 2)\overline{585\frac{1}{4}}$

$e.\ 5)\overline{895\frac{5}{6}}$　　$f.\ 6)\overline{967\frac{1}{2}}$　　$g.\ 3)\overline{741\frac{3}{8}}$　　$h.\ 4)\overline{652\frac{4}{5}}$

$i.\ 7)\overline{435\frac{1}{6}}$　　$j.\ 8)\overline{578\frac{2}{3}}$　　$k.\ 9)\overline{380\frac{1}{4}}$　　$l.\ 8)\overline{432\frac{1}{2}}$

$m.\ 4)\overline{894\frac{4}{5}}$　　$n.\ 5)\overline{947\frac{1}{3}}$　　$o.\ 6)\overline{749\frac{1}{2}}$　　$p.\ 7)\overline{604\frac{4}{5}}$

Sight Exercises

Give quotients:

$a.\ 2)\overline{19\frac{1}{2}}$　　$b.\ 2)\overline{21\frac{1}{3}}$　　$c.\ 2)\overline{13\frac{2}{3}}$　　$d.\ 2)\overline{21\frac{1}{4}}$

$e.\ 3)\overline{10\frac{1}{3}}$　　$f.\ 3)\overline{16\frac{2}{5}}$　　$g.\ 3)\overline{14\frac{1}{2}}$　　$h.\ 3)\overline{25\frac{1}{4}}$

Fractional Divisors

Preparatory Exercises

1. When muslin costs 8 cents per yard, what is the cost (*a*) of 2 yards? (*b*) Of $2\frac{1}{4}$ yards? (*c*) Of $1\frac{1}{2}$ yards? (*d*) Of $\frac{5}{8}$ yard?

2. What is the product of 8¢ (*a*) by 2? (*b*) By $2\frac{1}{4}$? (*c*) By $1\frac{1}{2}$? (*d*) By $\frac{5}{8}$?

3. When muslin costs 8 cents per yard, what quantity can be bought (*a*) for 16 cents? (*b*) For 18¢? (*c*) For 12¢? (*d*) For 5¢?

4. What is the quotient of (*a*) 16¢ ÷ 8¢? (*b*) 18¢ ÷ 8¢? (*c*) 12¢ ÷ 8¢? (*d*) 5¢ ÷ 8¢?

5. What is the cost of muslin per yard (*a*) when 2 yards cost 16 cents? (*b*) When $2\frac{1}{4}$ yards cost 18¢? (*c*) When $1\frac{1}{2}$ yards cost 12¢? (*d*) When $\frac{5}{8}$ yard costs 5¢?

ANALYSIS		

b. $2\frac{1}{4}$) 18¢   *c.* $1\frac{1}{2}$) 12¢   *d.* $\frac{5}{8}$)   5¢

     × 4   × 4   × 2   × 2   ×8   × 8

      9)   72¢   3)   24¢   5)   40¢

     Ans.   8¢   *Ans.*   8¢   *Ans.*   8¢

Multiply the divisor and the dividend in (*b*) by 4, in (*c*) by 2, and in (*d*) by 8, making the new divisors 9, 3, and 5, respectively; and the new dividends 72¢, 24¢, and 40¢, respectively. Divide the new dividends by the new divisors.

Test each result by multiplying it by the *original* divisor. The product should be the *original* dividend.

     b. $2\frac{1}{4} \times 8$¢   *c.* $1\frac{1}{2} \times 8$¢   *d.* $\frac{5}{8} \times 8$¢

6. Find the quotient (*a*) of 16¢ ÷ 2. (*b*) Of 20¢ ÷ $2\frac{1}{2}$. (*c*) Of 10¢ ÷ $1\frac{1}{4}$. (*d*) Of 5¢ ÷ $\frac{5}{8}$.

Sight Exercises

1. Divide by 1 half: *a.* 3 halves.   *b.* 4 halves.   *c.* 5 halves.   *d.* 7 halves.   *e.* 9 halves.

2. Divide by $\frac{1}{2}$: *a.* $\frac{3}{2}$.   *b.* $1\frac{1}{2}$.   *c.* 2.   *d.* $4\frac{1}{2}$.   *e.* 6.

3. Divide by 3 halves: *a.* 6 halves.   *b.* 9 halves.   *c.* 12 halves.   *d.* 15 halves.

4. Divide by $\frac{3}{2}$: *a.* $\frac{6}{2}$.   *b.* $\frac{9}{2}$.   *c.* $\frac{12}{2}$.   *d.* $\frac{15}{2}$.   *e.* $\frac{21}{2}$.

5. Divide by $1\frac{1}{2}$: *a.* 3.   *b.* $4\frac{1}{2}$.   *c.* 6.   *d.* $7\frac{1}{2}$.   *e.* $10\frac{1}{2}$.

6. Divide by $\frac{3}{4}$: *a.* $\frac{9}{4}$.   *b.* $\frac{12}{4}$.   *c.* $\frac{24}{4}$.   *d.* $\frac{30}{4}$.   *e.* $\frac{21}{4}$.

7. Divide by $\frac{3}{4}$: *a.* $2\frac{1}{4}$.   *b.* $1\frac{3}{4}$.   *c.* $1\frac{1}{2}$.   *d.* 3.   *e.* $2\frac{1}{4}$.

8. At $\$\frac{3}{4}$ per yard, how many yards of silk can be bought (*a*) for $\$5\frac{1}{4}$?   (*b*) For $\$7\frac{1}{2}$?   (*c*) For $\$9$?   (*d*) For $\$9\frac{1}{4}$? (*e*) For $\$9\frac{1}{2}$?

ANALYSIS

a	*b*	*c*	*d*	*e*
$\frac{3}{4})5\frac{1}{4}$	$\frac{3}{4})7\frac{1}{2}$	$\frac{3}{4})9$	$\frac{3}{4})9\frac{1}{4}$	$\frac{3}{4})9\frac{1}{2}$

Multiply the divisor and the dividend in each case by 4. This changes the foregoing to the following:

aa	*bb*	*cc*	*dd*	*ee*
3)21	3)30	3)36	3)37	3)38

Ans. 7 (yd.)   10 (yd.)   12 (yd.) $12\frac{1}{3}$ (yd.) $12\frac{2}{3}$ (yd.)

Observe that in dividing $5\frac{1}{4}$, etc., by $\frac{3}{4}$, the dividend ($5\frac{1}{4}$) is multiplied by 4 and the product is divided by 3; that is,

To divide by $\frac{3}{4}$, multiply by $\frac{4}{3}$; to divide by $\frac{1}{2}$, multiply by $\frac{2}{1}$; to divide by $\frac{1}{4}$, multiply by $\frac{4}{1}$; to divide by $\frac{2}{3}$, multiply by $\frac{3}{2}$.

To divide by a fraction, multiply by the inverted fraction.

Written Exercises

1. A farmer raised 32 bushels of corn on $\frac{3}{4}$ acre. (*a*) What was the yield per acre? (*b*) He raised $25\frac{5}{8}$ tons of alfalfa on $3\frac{3}{4}$ acres. Find the yield per acre.

PROCESS

a. 32 bu. $\div \frac{3}{4} = \frac{32}{1}$ bu. $\times \frac{4}{3} = \frac{128}{3}$ bu. $= 42\frac{2}{3}$ bu. *Ans.*

b. $25\frac{5}{8}$ T. $\div 3\frac{3}{4} = \frac{205}{8}$ T. $\div \frac{15}{4} = \frac{\overset{41}{\cancel{205}}}{\cancel{8}}$ T. $\times \frac{\cancel{4}}{\cancel{15}} = \frac{41}{6}$ T.
$$= 6\frac{5}{6} \text{ T. } \textit{Ans.}$$

In (*b*) first reduce the mixed numbers to improper fractions. Invert the divisor. Cancel.

---

2. Divide:

a. $78 \div \frac{3}{4}$	*b.* $77\frac{2}{5} \div \frac{3}{4}$	*c.* $79\frac{1}{3} \div 1\frac{3}{4}$	*d.* $79\frac{1}{3} \div 15\frac{3}{4}$
e. $48 \div \frac{2}{3}$	*f.* $48\frac{2}{9} \div \frac{2}{3}$	*g.* $48\frac{1}{9} \div 2\frac{2}{3}$	*h.* $47\frac{2}{9} \div 16\frac{2}{3}$
i. $82 \div \frac{7}{8}$	*j.* $82\frac{3}{5} \div \frac{7}{8}$	*k.* $82\frac{4}{5} \div 3\frac{3}{8}$	*l.* $82\frac{4}{5} \div 13\frac{1}{2}$

Written Problems

First indicate the operation required to solve each of the following:

1. When material costs $\$\frac{3}{8}$ per yard, how much can be bought (*a*) for $\$\frac{3}{4}$? (*b*) For $\$1$? (*c*) For $\$1\frac{1}{2}$?

2. What is the cost of 156 baseballs at $\$\frac{3}{4}$ each?

3. At $\frac{7}{8}$ inch each, how many inches of wire will be required for 112 nails?

4. How many nails $\frac{7}{8}$ inch long can be made from 112 inches of wire?

5. (*a*) What is $\frac{4}{5}$ of 240 acres? (*b*) If $\frac{4}{5}$ of a farm contains 240 acres, how many acres are there in the farm?

6. When tea is $\frac{2}{5}$ dollar per pound, how many pounds can be bought for $\$3\frac{8}{10}$?

Multiplication or Division

Preparatory Exercises

1. A storekeeper has 120 yards of cloth. How many yards has he sold when he has sold (*a*) $\frac{1}{2}$ of it? (*b*) $\frac{1}{3}$? (*c*) $\frac{1}{4}$? (*d*) $\frac{1}{5}$? (*e*) $\frac{1}{6}$? (*f*) $\frac{1}{8}$? (*g*)$\frac{1}{10}$? (*h*) $\frac{2}{3}$? (*i*) $\frac{3}{4}$? (*j*) $\frac{2}{5}$? (*k*) $\frac{3}{5}$? (*l*) $\frac{4}{5}$? (*m*) $\frac{5}{6}$? (*n*) $\frac{3}{8}$? (*o*) $\frac{5}{8}$?

To find the answers to the foregoing questions, is 120 multiplied or divided by the respective fractions?

2. A grocer sold 60 pounds of coffee. How many pounds did he have at first if 60 pounds was (*a*) $\frac{1}{2}$ the original quantity? (*b*) $\frac{1}{3}$? (*c*) $\frac{1}{4}$? (*d*) $\frac{1}{5}$? (*e*) $\frac{1}{6}$? (*f*) $\frac{1}{8}$? (*g*) $\frac{1}{10}$? (*h*) $\frac{2}{3}$? (*i*) $\frac{3}{4}$? (*j*) $\frac{2}{5}$? (*k*) $\frac{3}{5}$?

To find the answers to these questions, is 60 multiplied or divided by the respective fractions?

NOTE. — In dividing 60 by $\frac{2}{3}$, $\frac{3}{4}$, etc., find $\frac{1}{2}$, $\frac{1}{3}$, etc., of 60.

3. A farmer raised 120 tons of hay. What fraction of his crop did he sell if he sold (*a*) 10 T.? (*b*) 20 T.? (*c*) 30 T.? (*d*) 40 T.? (*e*) 60 T.? (*f*) 12 T.?

Is 120 the divisor or the dividend?

4. Mr. Schlaefer's hens laid on an average 120 eggs in 1914. By what fraction was 1914's average increased if the average in 1915 was (*a*) 130 eggs? (*b*) 140 eggs? (*c*) 150 eggs? (*d*) 160 eggs? (*e*) 180 eggs? (*f*) 132 eggs?

5. By what fraction would 1914's average of 120 eggs be diminished if it had fallen off to (*a*) 110 eggs? (*b*) 100 eggs? (*c*) 90 eggs? (*d*) 114 eggs?

6. (*a*) By what fraction is the yield of corn increased when it increases from 36 bushels to 40 bushels? (*b*) By what fraction is the yield diminished when it decreases from 40 bushels to 36 bushels?

7. A class has 40 pupils. What fraction is present when there are present (*a*) 39 pupils? (*b*) 38 pupils? (*c*) 37 pupils? (*d*) 36 pupils? (*e*) 35 pupils? (*f*) 34 pupils? (*g*) 32 pupils?

8. What fraction of a school of 120 pupils is absent when there are present (*a*) 118 pupils? (*b*) 117 pupils? (*c*) 116 pupils? (*d*) 115 pupils? (*e*) 114 pupils? (*f*) 112 pupils? (*g*) 110 pupils? (*h*) 108 pupils?

9. In a class there are 36 pupils present. How many belong to the class if (*a*) $\frac{6}{7}$ of the pupils are present? (*b*) $\frac{9}{10}$? (*c*) $\frac{12}{13}$? (*d*) $\frac{3}{4}$? (*e*) $\frac{4}{5}$?

Is the number belonging to the class greater or less than 36?

When you divide by a proper fraction, is the quotient greater or less than the dividend?

10. How many pupils belong to a school if 120 are present and the fraction absent is (*a*) $\frac{1}{8}$ of the whole number? (*b*) $\frac{1}{4}$? (*c*) $\frac{1}{5}$? (*d*) $\frac{1}{6}$? (*e*) $\frac{1}{7}$? (*f*) $\frac{1}{9}$? (*g*) $\frac{1}{11}$? (*h*) $\frac{1}{13}$? (*i*) $\frac{1}{16}$? (*j*) $\frac{1}{21}$? (*k*) $\frac{1}{25}$? (*l*) $\frac{1}{31}$? (*m*) $\frac{1}{41}$?

11. A girl pays 50 cents for 5 quarter-pound boxes of candy. (*a*) What was the price per box? (*b*) What was the price per pound?

12. At $\$ \frac{3}{4}$ each, how many baseballs can be bought for $12?

13. (*a*) When a man sells for $180 a horse that cost him $150, what fraction of the cost does he gain? (*b*) When a man sells for $150 a horse that cost him $180, what fraction of the cost does he lose?

Sight Exercises

1. A woman has 36 hens.   How many does she sell if she sells (*a*) $\frac{1}{2}$ of them?   (*b*) $\frac{1}{3}$?   (*c*) $\frac{2}{3}$?   (*d*) $\frac{1}{4}$? (*e*) $\frac{3}{4}$?

2. A man buys a cow for $36.   What fraction of the cost does he gain if he sells it at a profit of (*a*) $2? (*b*) $3?   (*c*) $4?   (*d*) $6?   (*e*) $9?   (*f*) $12?

3. What fraction of the cost does a boy gain when he buys an article for 36 cents and sells it for (*a*) 40 cents? (*b*) 42¢?   (*c*) 45¢?   (*d*) 39¢?   (*e*) 38¢?

4. What fraction of the cost is lost when an article costing 36 cents is sold for (*a*) 32 cents?   (*b*) 34¢? (*c*) 33¢?   (*d*) 30¢?

5. (*a*) What fraction of 36 is 27?   (*b*) 27 = 36 multiplied by what?   (*c*) What fraction of 27 is 36? (*d*) 27 multiplied by what equals 36?

6. (*a*) At $\frac{2}{5}$ per pound, how much tea can be bought for $\frac{3}{5}$?   (*b*) $\frac{3}{5} + \frac{2}{5} = ?$ (*c*) $60 \div 40 = ?$

7. (*a*) At $\frac{3}{5}$ per yard, how much linen can be bought for $\frac{2}{5}$?   (*b*) $\frac{2}{5} + \frac{3}{5} = ?$ (*c*) $40 \div 60 = ?$

Written Exercises

Find the missing quantity:

a. $\frac{4}{5}$ of $120 = ?$ *b.* $\frac{4}{5}$ of $? = 96$ *c.* $96 = ?$ of 120

  Is the answer in (*a*) greater or less than 120?
  In (*b*) is it greater or less than 96?
  In (*c*) is it greater or less than 1?

d. $75 = \frac{5}{8}$ of ?   *e.* $\frac{9}{5}$ of $? = 108$ *f.* $48 = ?$ of 84
g. $\frac{11}{8}$ of $? = 132$ *h.* $1\frac{5}{7} \times 16\frac{1}{3} = ?$ *i.* $5\frac{1}{4} = \frac{17}{8}$ of ?
j. $37\frac{1}{2} = ?$ of $31\frac{1}{4}$ *k.* $\frac{9}{8}$ of $? = 117$ *l.* $42\frac{1}{2} = 2\frac{1}{8} \times ?$
m. $\frac{8}{3}$ of $15\frac{3}{4} = ?$ *n.* $? \times 2\frac{2}{9} = 45$ *o.* $\frac{7}{4}$ of $? = 36\frac{3}{4}$

Sight Drills

1. What is the cost of $\frac{4}{5}$ acres of land at $60 per acre?

$$\frac{4}{5} \text{ times } \$60 = \text{Cost.}$$

2. Give answers :

a. $\frac{4}{5} \times 60 = ?$ *b.* $\frac{3}{4} \times 16 = ?$ *c.* $\frac{1}{3} \times 24 = ?$ *d.* $\frac{7}{8} \times 48 = ?$

e. $\frac{1}{2} \times 70 = ?$ *f.* $\frac{4}{9} \times 36 = ?$ *g.* $\frac{1}{4} \times 88 = ?$ *h.* $\frac{3}{8} \times 24 = ?$

i. $\frac{1}{5} \times 40 = ?$ *j.* $\frac{3}{4} \times 32 = ?$ *k.* $\frac{5}{6} \times 60 = ?$ *l.* $\frac{5}{6} \times 72 = ?$

3. When 75 cents is paid for $\frac{5}{4}$ yards of linen, what is the price per yard?

When $\frac{5}{4} \times$ price $= 75\not\!c$, the price $= 75\not\!c \div \frac{5}{4}$.
Ans. $\frac{4}{5}$ of $75\not\!c$.   Why?

4. Give answers :

a. $\frac{5}{4} \times ? = 60$ *b.* $\frac{8}{9} \times ? = 56$ *c.* $\frac{4}{3} \times ? = 12$ *d.* $\frac{4}{5} \times ? = 44$

e. $\frac{2}{3} \times ? = 18$ *f.* $\frac{1}{9} \times ? = 90$ *g.* $\frac{4}{5} \times ? = 80$ *h.* $\frac{1}{4} \times ? = 32$

5. A quantity of lard at 18 cents per pound cost 27 cents. What was the quantity?

When the number of pounds $\times 18\not\!c = 27\not\!c$, the number of pounds $= 27\not\!c \div 18\not\!c$.

NOTE.—In giving answers to the following do not change the improper fractions in the results to mixed numbers.

6. Give answers in fractions, proper or improper :

a. $? \times 36 = 30$ *b.* $? \times 36 = 42$ *c.* $? \times 99 = 11$ *d.* $? \times 42 = 48$

e. $? \times 18 = 24$ *f.* $? \times 88 = 33$ *g.* $? \times 33 = 44$ *h.* $? \times 64 = 16$

7. (*a*) At $\frac{2}{5}$ mile per minute, how long would a train require to go $\frac{3}{4}$ mile?   (*b*) At $\frac{3}{4}$ mile per minute, how long would a train require to go $\frac{2}{5}$ mile?

8. Give answers :

a. $36 = 30 \times ?$ *b.* $30 = 35 \times ?$ *c.* $36 = 60 \times ?$ *d.* $28 = 40 \times ?$

e. $24 = 40 \times ?$ *f.* $66 = 44 \times ?$ *g.* $40 = 24 \times ?$ *h.* $40 = 16 \times ?$

i. $45 = 18 \times ?$ *j.* $30 = 48 \times ?$ *k.* $18 = 81 \times ?$ *l.* $48 = 36 \times ?$

Sight Problems

1. If ⅔ bushels of seed wheat are used to the acre, how many acres will require 48 bushels of seed ?

2. How much lace is used, on an average, in trimming a hat when 40 yards of lace are used in trimming 45 hats ?

3. When coffee sells for 32 cents a pound, (*a*) how many ounces can be bought for 24 cents ? (*b*) What fraction of a pound ?

4. At the rate of ¾ mile per minute, how far does a train go in an hour ?

5. What part of a gross (12 dozen) of pencils has a stationer sold when he has sold 120 pencils ?

6. When a boy has spent ⅕ of his money, (*a*) what fraction of it is left ? (*b*) If he has 20 cents left, how much money had he at first ?

7. After selling ¾ of his sheep, a farmer still had 20 sheep. (*a*) How many sheep did he sell ? (*b*) How many had he at first ?

8. Last year Mr. X raised 24 bushels of wheat to the acre ; this year he has raised 30 bushels to the acre. (*a*) This year's yield is what fraction of last year's ? (*b*) The increase in this year's yield is what fraction of last year's yield ?

9. Last year Mr. Y raised 30 bushels to the acre ; this year he has raised only 24 bushels to the acre. (*a*) This year's yield is what fraction of last year's ? (*b*) The decrease in this year's yield is what fraction of last year's yield ?

10. Fred spent 60 cents and had 40 cents left. (*a*) What fraction of his money did he spend ? (*b*) What fraction of it remained ?

Written Problems

1. When ¾ bushel of seed is used to plant an acre, how many acres can be planted with 117 bushels of seed?

2. If 112 yards of lace are used in trimming 12 dozen hats, how much is required on an average for each?

3. When velvet sells at $2.25 per yard, (*a*) what part of a yard can be bought for $1.75? (*b*) How many inches? (*c*) How many feet and inches?

4. At the rate of ⅗ mile per minute, how far can a train go in 2¼ hours?

5. What part of a gross of pens is 10⅔ dozen pens?

6. After selling ⅖ of his land, a man has 450 acres remaining. How many acres had he at first?

7. After selling ⅘ of his farm, M has 213½ acres left. (*a*) How many acres did he sell? (*b*) How many acres were there in the farm?

8. Last year's crop averaged 22¼ bushels of wheat to the acre; this year averaged 31½ bushels. (*a*) This year's yield is what fraction of last year's? (*b*) The increased yield is what fraction of last year's average?

9. Mr. Cox raised last year 31¼ bushels to the acre; this year he raised only 22½. What fraction of last year's yield is this year's yield?

10. After spending $18¾ for clothes, a boy has $12.50 left. (*a*) What fraction of his money did he spend? (*b*) What fraction remained?

11. A woman paid $1.65 for 5 three-quarter pound packages of tea. Find (*a*) the price of each package. (*b*) The cost of the tea by the pound.

12. At $¾ per pound, how many pounds of tea will cost $18¾?

Aliquot Parts of a Dollar

Preparatory Exercises

1. How many cents are there (*a*) In $\$\frac{1}{2}$? (*b*) In $\$\frac{1}{4}$?

2. What part of a dollar is (*a*) 50¢? (*b*) 12½¢? (*c*) 25¢?

3. At $\$\frac{1}{4}$ each, find the cost (*a*) of 24 baseballs. (*b*) Of 36 baseballs. (*c*) Of 48 baseballs. (*e*) Of 88 baseballs.

Written Exercises

1. Find the cost of 48 yards of cloth (*a*) at $\$2.25$ per yard. (*b*) At $\$2.12\frac{1}{2}$ per yard.

	PROCESS	
a. $\$2\frac{1}{4}$	In (*a*) indicate the product	*b.* $\$2\frac{1}{8}$
$\times 48$	of $\$2\frac{1}{4}$ by 48. Use, however,	$\times 48$
12	$2\frac{1}{4}$ as a multiplier. Write 12,	6
96	($\frac{1}{4}$ of 48) then 96 (twice 48).	96
$\$108$ *Ans.*	Combine the partial products.	$\$102$ *Ans.*

2. Find answers (change the cents to fraction of a dollar):

a.	$\$2.50$	*b.*	$\$3.12\frac{1}{2}$	*c.*	$\$4.25$	*d.*	$\$5.50$	*e.*	$\$6.12\frac{1}{2}$
	$\times 72$		$\times 72$		$\times 72$		$\times 72$		$\times 72$

Sight Exercises

1. Give products :

a.	$\$0.25$	*b.*	$\$0.12\frac{1}{2}$	*c.*	$\$0.50$	*d.*	$\$0.50$	*e.*	$\$0.12\frac{1}{2}$
	$\times 36$		$\times 48$		$\times 24$		$\times 22$		$\times 88$

f.	$\$0.50$	*g.*	$\$0.12\frac{1}{2}$	*h.*	$\$0.25$	*i.*	$\$0.25$	*j.*	$\$0.12\frac{1}{2}$
	$\times 224$		$\times 808$		$\times 484$		$\times 448$		$\times 816$

Preparatory Exercises

1. At 50 cents each, how many articles can be bought (*a*) for $1? (*b*) For $2? (*c*) For $3? (*d*) For $$\frac{1}{2}$$?

2. At 25 cents each, how many baseballs can be bought (*a*) for $1? (*b*) For $2? (*c*) For $3? (*d*) For $$\frac{1}{4}$$? (*e*) For $$\frac{1}{2}$$? (*f*) For $$\frac{3}{4}$$? (*g*) For $1$$\frac{1}{4}$$? (*h*) For $1$$\frac{1}{2}$$?

3. At 12$$\frac{1}{2}$$ cents per yard, how many yards can be bought (*a*) for $1? (*b*) For $2? (*c*) For $3? (*d*) For $$\frac{1}{2}$$? (*e*) For $$\frac{1}{4}$$? (*f*) For $1$$\frac{1}{8}$$? (*g*) For $1$$\frac{1}{4}$$? (*h*) For $1$$\frac{1}{2}$$?

Sight Exercises

1. Give quotients :

a. $$\frac{1}{2}$$)$25   *b.* $$\frac{1}{4}$$)$21   *c.* $$\frac{1}{8}$$)$11   *d.* $$\frac{1}{2}$$)$13

e. $$\frac{1}{2}$$)$24$$\frac{1}{2}$$ *f.* $$\frac{1}{4}$$)$21$$\frac{1}{4}$$ *g.* $$\frac{1}{8}$$)$11$$\frac{1}{8}$$ *h.* $$\frac{1}{4}$$)$11$$\frac{1}{2}$$

Written Exercises

1. At 12$$\frac{1}{2}$$ cents per yard, how many yards can be bought (*a*) for $24$$\frac{1}{4}$$? (*b*) For $37$$\frac{3}{8}$$? (*c*) For $42$$\frac{1}{2}$$?

PROCESS

a	*b*	*c*
$.12$$\frac{1}{2}$$)$24$$\frac{1}{4}$$	$.12$$\frac{1}{2}$$)$37$$\frac{3}{8}$$	$.12$$\frac{1}{2}$$)$42$$\frac{1}{2}$$
Ans. 194 (yd.)	*Ans.* 299 (yd.)	*Ans.* 340 (yd.)

The quotient (*a*) of $24$$\frac{1}{4}$$ by $$\frac{1}{8}$$ is 8 times 24$$\frac{1}{4}$$.

---

2. At 8 yards for $1, how many yards can be bought for (*a*) $33? (*b*) $42$$\frac{1}{4}$$? (*c*) $62$$\frac{1}{2}$$? (*d*) $37$$\frac{3}{4}$$?

3. Find quotients :

a. $.25)$37   *b.* $ .25)$42$$\frac{1}{4}$$ *c.* $.25)$63$$\frac{1}{4}$$

d. $.25)$18$$\frac{3}{4}$$ *e.* $.12$$\frac{1}{2}$$)$62   *f.* $.12$$\frac{1}{2}$$)$56$$\frac{1}{4}$$

Bills

Thomas J. Farrell has bought goods from Ryan and Taylor, from whom he receives the following bill :

MARION, IND., Nov. 4, 1916

MR. THOMAS J. FARRELL
    376 Main Street

Bought of RYAN AND TAYLOR

WHOLESALE GROCERS

4 Market Square

48 lb. Coffee	*.25*	*12*	
6 bbl. Flour	*6.50*		
80 lb. Sugar	*.05½*		
4½ lb. Butter	*.30*		
1 case Tomatoes		*1*	*25*
12 gal. Sirup	*.43*		
Received payment			$
Nov. 30, 1916			
Ryan and Taylor			
per F. O'M.			

Written Exercise

Copy this bill, dating it to-day, using your own name as purchaser, and inserting your address.

Write in the first double column the amount of the separate items (*extensions*) and place the total (the *footing*) in the second double column, on the line below the last item.

Assume that the bill is paid a few days later ; receipt it as shown above. After the word *per* (which means "by"), write the initials of a classmate.

Sight Exercises

· Give the cost of each item:

1.	*a.*	13 lb. Coffee	at	30 ¢
	b.	120 lb. Sugar	at	6 ¢
	c.	48 gal. Oil	at	12½ ¢
	d.	1 bbl. Flour	at	$5.75
	e.	4½ lb. Tea	at	60 ¢
2.	*a.*	10 doz. Plates	at	72 ¢
	b.	3 Bowls	at	56 ¢
	c..	2⅓ doz. Dishes	at	80 ¢
	d.	1 Tea Set	at	$4.50
3.	*a.*	4½ yd. Ribbon	at	30 ¢
	b.	1 Suit	at	$2.40
	c.	2 pc. Braid	at	34 ¢
	d.	10½ yd. Silk	at	$1.20
	e.	1 pr. Gloves	at	$1.50
4.	*a.*	4 doz. Bolts	at	$1.25
	b.	½ doz. Chisels	at	$6.00
	c.	50 lb. Nails	at	6½ ¢
	d.	4 Planes	at	$2.50
	e.	1½ doz. Shovels	at	$10.00

Written Exercises

1. Make out and receipt bills for the foregoing articles, naming a local merchant as the seller and yourself as the purchaser.

Write the extensions and the footings at once in their proper column, without using a separate sheet for the calculations. When only one article of a kind is bought, place its price only in the column of extensions. Do not employ "at" or other unnecessary words or signs.

2. Make out bills for the foregoing purchases at the prices prevailing in your local stores.

Decimals — Two Places

Preparatory Exercises

1. With what four pieces of money can you pay a bill of $11.11 ?

2. If you received $43.21 in $4 + 3 + 2 + 1$ pieces of money, what is the value (*a*) of each of the 4 gold coins? (*b*) Of each of the 3 silver coins or paper bills? (*c*) Of each of the 2 silver coins? (*d*) Of the bronze piece?

Writing Decimals

Forty-three dollars and twenty-one cents is generally written $43.21, a period being used to separate the dollars from the cents.

The mixed number 43 and 21 hundredths is written in the decimal form as 43.21, a period, called the decimal point, being used to separate 43 (the whole number) from 21 hundredths (the decimal).

Three and seven tenths is written 3.7 ; forty-three hundredths is written .43 ; nine hundredths is written .09.

Written Exercises

Express in decimal form :

(*a*) 43 and 7 tenths.   (*b*) 23 hundredths.   (*c*) 8 and 6 hundredths.   (*d*) 94 and 17 hundredths.   (*e*) 5 and 9 tenths.

Reading Decimals

In reading a mixed decimal, use *and* between the whole number and the decimal. Read a one-place decimal, such as .2, .3, etc., as *tenths ;* a two-place decimal, such as .16, .07, etc., as *hundredths.*

Addition and Subtraction

Sight Exercises

1. Give sums:

a. 6.5	*b.* 16.21	*c.* 24.3	*d.* 4.5	*e.* 12.09
+ 4.12	+ 5.04	+ 8.09	+ .6	+ 3.1

2. Add (*a*) 12.6 miles and 3.4 miles. (*b*) 12.75 feet and 2.25 feet. (*c*) 12.05 acres and 12.05 acres.

PROCESS

a. 12.6 mi.	*b.* 12.75 ft.	*c.* 12.05 A.
+ 3.4	+ 2.25	+ 2.05
Ans. 16 mi.	*Ans.* 15 ft.	*Ans.* 14.1 A.

In (*a*) omit .0. In (*b*) omit .00. In (*c*) omit the terminal 0.

---

3. Give sums :

a. 12.6	*b.* 16.99	*c.* 18.75	*d.* 14.06	*e.* 13.03
+ .4	+ 1.01	+ .25	+ 1.04	+ .07

4. From 18.25 miles take (*a*) 9.25 miles. (*b*) 9.75 miles. From 10 acres (*c*) 9.5 acres. (*d*) 9.25 acres.

PROCESS

a. 18.25 mi.	*b.* 18.25 mi.	*c.* 10 A.	*d.* 10 A.
− 9.25	9.75	9.5	9.25
Ans. 9 mi.	*Ans.* 8.5 mi.	*Ans.* .5 A.	*Ans.* .75 A.

---

5. Give remainders :

a. 6.5	*b.* 16.21	*c.* 24.3	*d.* 4.5	*e.* 12.09
− 4.25	− 5.04	− 8.09	− .6	− 3.19

Written Exercises

1. A man's farm consists of 3 and 45 hundredths acres in woods, 8 tenths of an acre as a garden, 150 and 6 hundredths acres in grain, and 25 and 39 hundredths acres as an orchard.   How many acres are there in the farm?

> **PROCESS**
>
> 3.45 A.   Keep the decimal points in a column.
> .8   Think: 15, 20; do not write 0.   Carrying 2,
> 150.06   think, 5, 13, 17; write 7; etc.   Place a deci-
> 25.39   mal point in the sum underneath the decimal
> ——————   point   in   the   addends.   Test   by   adding
> *Ans.* 179.7 A.   downward.

2. Add :

a.   3.47 + .34 + 2.5 + 46.6 + 210.7 + 25.39

b.   12.25 + 6.76 + 4.4 + 89.3 + 165.02 + .84

c.   .21 + 186.4 + 98.08 + 13.2 + 5.57 + 213.6

3. An engineer is making a trip of 108.2 miles.   How far has he still to go when he has gone (*a*) 69.35 miles ? (*b*) 69.2 miles ?

> **PROCESS**
>
> *a.* 108.2 mi.   Do   not   write   a   ter-   *b.* 108.2 mi.
> 69.35   minal cipher in the min-   − 69.2
> ——————   uend   of   *a*.   In   *b*   omit   —————
> *Ans.* 38.85 mi.   decimal cipher.   *Ans.* 39 mi.

4. Subtract :

 a.   49.5 − 9.76   *b.*   68.03 − 28.4   *c.*   100.43 − 25.68

 d.   58.3 − 8.64   *e.*   813.47 − 10.9   *f.*   201.71 − 65.84

 g.   60.4 − 7.85   *h.*   92.15 − 36.8   *i.*   315.22 − 96.67

Reductions

Sight Exercises

1. Change to common fractions — lowest terms :

a. .2	*b.* .02	*c.* .12	*d.* .32	*e.* .42	*f.* .52
g. .4	*h.* .04	*i.* .24	*j.* .44	*k.* .64	*l.* .84
m. .5	*n.* .05	*o.* .35	*p.* .55	*q.* .75	*r.* .95
s. .6	*t.* .06	*u.* .46	*v.* .66	*w.* .86	*x.* .96

2. Change the fractions in the first column to *tenths;* those in the other columns to *hundredths.*

a. $\frac{1}{2}$	*b.* $\frac{1}{25}$	*c.* $\frac{1}{50}$	*d.* $\frac{9}{20}$	*e.* $\frac{6}{25}$	*f.* $\frac{41}{50}$
g. $\frac{1}{4}$	*h.* $\frac{1}{20}$	*i.* $\frac{3}{50}$	*j.* $\frac{11}{20}$	*k.* $\frac{8}{25}$	*l.* $\frac{31}{50}$
m. $\frac{1}{5}$	*n.* $\frac{2}{25}$	*o.* $\frac{7}{50}$	*p.* $\frac{13}{20}$	*q.* $\frac{11}{25}$	*r.* $\frac{21}{50}$
s. $\frac{2}{5}$	*t.* $\frac{3}{20}$	*u.* $\frac{9}{50}$	*v.* $\frac{17}{20}$	*w.* $\frac{21}{25}$	*x.* $\frac{48}{50}$

Multiplying Decimals

Preparatory Exercises

Give results in decimals, lowest terms.

1. Multiply 3 tenths (*a*) by 2; (*b*) by 3; (*c*) by 5; (*d*) by 9; (*e*) by 8.

2. Multiply 12 hundredths (*a*) by 4; (*b*) by 5; (*c*) by 7; (*d*) by 9; (*e*) by 10.

3. Multiply .25 (*a*) by 3; (*b*) by 2; (*c*) by 5; (*d*) by 4; (*e*) by 6.

4. Multiply 2.5 (*a*) by 5; (*b*) by 2; (*c*) by 4; (*d*) by 8; (*e*) by 3.

5. Multiply 1.25 (*a*) by 4; (*b*) by 7; (*c*) by 9; (*d*) by 8; (*e*) by 10.

Decimal in Multiplicand

Written Exercises

1. At 37.25 tons each, what is the weight (*a*) of 5 cars? (*b*) Of 6? (*c*) Of 8?

PROCESS

a. 37.25 T.	*b.* 37.25 T.	*c.* 37.25 T.
× 5	× 6	× 8
Ans. 186.25 T.	*Ans.* 223.5 T.	*Ans.* 298 T.

Write the decimal point in the product when it is reached in performing the multiplication. In (*b*) omit the cipher in hundredths' place. In (*c*) omit both decimal ciphers.

---

2. Find products:

a. 7 × 82.5   *b.* 18.55 × 8   *c.* 3 × 9.56   *d.* 98.5 × 2
e. 5 × 73.9   *f.* 27.35 × 6   *g.* 5 × 8.44   *h.* 37.5 × 4

3. (*a*) At 26 bushel to the acre, how many bushels of wheat will 8.75 acres yield? (*b*) What will be the yield of 54 acres of potatoes at 87.5 bushels to the acre?

PROCESS

a.   8.75
   × 26 bu.
   ‾‾‾‾‾‾
   5250
   1750
Ans. 227.5̸0̸ bu.

In (*a*) use 26 as the multiplier. Reject the terminal decimal cipher in the product.
Omit decimal points in the partial products.

b.   87.5 bu.
   × 54
   ‾‾‾‾‾
   3500
   4375
Ans. 4725.0̸ bu.

---

4. Find products:

a. 23 × 69.7   *b.* 9.25 × 24   *c.* 92 × 69.75   *d.* 17.5 × 96
e. 32 × 58.9   *f.* 7.34 × 45   *g.* 88 × 58.25   *h.* 23.4 × 85

Decimal Quotients

Preparatory Exercises

1. Give answers : *a.* 4)$2.84. *b.* 5)$2.05. *c.* 4)$1.64.

2. Divide by 3 : *a.* 9 tenths. *b.* 69 hundredths.

3. Divide by 2 : *a.* 10 hundredths. *b.* 1 tenth.

Sight Exercises

Give quotients :

a. 2).46 *b.* 2)1.24 *c.* 2).1 *d.* 4)2 *e.* 4)18.

f. 3).99 *g.* 3)1.86 *h.* 5).3 *i.* 6)3 *j.* 5)18.

Written Exercises

1. (*a*) What is the weight of a spike, when 375 weigh 120 pounds? (*b*) A piece of ground containing 145.2 acres is divided into 24 building plots; how many acres are there in each ?

PROCESS

a.   .32 lb. *Ans.*   *b.*   6.05 A. *Ans.*

  375)120.0 lb.   24)145.2 A.

    112 5   144

      7 50   1 20

      7 50   1 20

Divide as in the case of whole numbers, annexing decimal ciphers in the dividend when necessary. Place a decimal point in the quotient over the decimal point in the dividend.

---

2. Divide :

a. 35.25 ÷ 15   *b.* 700 ÷ 56   *c.* 11 ÷ 44   *d.* 13.44 ÷ 24

e. 69.75 ÷ 25   *f.* 909 ÷ 36   *g.* 36 ÷ 48   *h.* 10.24 ÷ 32

Multiplying by 10 and by 100

Preparatory Exercises

1. Multiply by 10 : *a.* 2. *b.* 3 tenths. *c.* 2 and 3 tenths.
d. 23 hundredths.

> *To multiply a decimal by* 10, *move the decimal point
> in the multiplicand one place to the right.*

Sight Exercises

2. Give products :

a. 10 × 1.2	*b.* 1.23 × 10	*c.* 12.3 × 10	*d.* 10 × 12.34
e. 10 × 2.3	*f.* 2.34 × 10	*g.* 23.4 × 10	*h.* 10 × 23.45
i. 10 × 3.4	*j.* 3.45 × 10	*k.* 34.5 × 10	*l.* 10 × 45.67
m. 10 × 4.5	*n.* 4.56 × 10	*o.* 45.6 × 10	*p.* 10 × 67.89

Preparatory Exercises

3. Multiply by 100 : *a.* 2. *b.* 3 tenths. *c.* 2 and 3
tenths. *d.* 22 hundredths.

> *To multiply a decimal by* 100, *move the decimal point in
> the multiplicand two places to the right, adding a cipher
> if necessary.*

Sight Exercises

4. Give products :

a. 100 × 1.23	*b.* 1.2 × 100	*c.* 100 × 12.3	*d.* 100 × 12.34
e. 100 × 2.34	*f.* 2.3 × 100	*g.* 100 × 23.4	*h.* 100 × 23.45
i. 100 × 3.45	*j.* 3.4 × 100	*k.* 100 × 34.5	*l.* 100 × 34.56
m. 100 × 4.56	*n.* 4.5 × 100	*o.* 100 × 45.6	*p.* 100 × 45.67

Dividing by 10 and by 100

Preparatory Exercises

1. Divide by 10 :   *a.* 20.   *b.* 3.   *c.* 23.   *d.* 3 tenths.

> *To divide a number by* 10, *move the decimal point in the dividend one place to the left; to divide by* 100 *move it two places.*

2. Divide by 100 : *a.* 200.   *b.* 230.   *c.* 33.   *d.* 233.

3. Give quotients :

a. 846 ÷ 10 *b.* 846 ÷ 100 *c.* 84.6 ÷ 10 *d.* 8460 ÷ 10
e. 846 ÷ 20 *f.* 846 ÷ 200 *g.* 84.6 ÷ 20 *h.* 8460 ÷ 20

Written Exercises

1. *a.* If 89.2 tons of hay are raised on 40 acres, what is the average per acre ?   *b.* Divide 892 ft. by 400.

> **PROCESS**
>
> *a.*   4∅)8.9/2 T.   Cancel 0 in the divisor and move the deci-
>   *Ans.*   2.23 T.   mal point in the dividend one place to the
>   left.   Divide 8.92 by 4.
> *b.*   4∅∅)8.92/ ft.   Cancel two ciphers in the divisor and point
>   *Ans.*   2.23 . ft. off.two decimal places in the dividend.
>   In changing the divisor 40 to 4, by what
> has 40 been divided?   In changing 892 to 8.92, by what has 892
> been divided?
>
> *A quotient is not changed when the divisor and the dividend are divided by the same number.*

2. Find quotients :

a. 488 ÷ 40   *b.* 486 ÷ 300   *c.* 48.8 ÷ 40   *d.* 486 ÷ 40
e. 584 ÷ 40   *f.* 675 ÷ 500   *g.* 64.8 ÷ 30   *h.* 486 ÷ 50

Sight Problems

1. John is driving to Burktown, 20 miles away. How many miles has he to go after driving 9.5 miles?

2. Find the area of a rectangular piece of ground 4.25 rods long and 4 rods wide.

3. If a machine can cut a field of grass in 5 days, what decimal of the field can it cut in one day?

4. How long would a machine take to cut a field of grain if it cuts .25 of it in a day?

5. A can do .07 of a piece of work in a day, B can do .08 of it in a day, and C .1 of it in a day. (*a*) What decimal of the work can all three do in a day? (*b*) How many days would all three require, working together, to do it?

6. After selling 12.6 acres of land, a man has 12.4 acres remaining; how many acres had he at first?

7. How many miles would a train go in 4 hours at the rate of 40.5 miles per hour?

8. How many hours would a train require to go 90.6 miles at the rate of 30.2 miles per hour?

9. How much longer than a yard is the French meter which contains 39.37 inches?

10. A man bought a horse for $200. He sold it at a profit of .2 times the cost. (*a*) What profit did he make? (*b*) What was the selling price?

11. A farmer bought a cow for $50. He sold it for $60. (*a*) What was his profit? (*b*) What fraction of the cost was the profit? (*c*) What decimal?

12. At $8 per thousand what is the cost of 4.5 thousand bricks?

Written Problems

1. A train starts for Seattle, 1000 miles distant. How far is it from Seattle when it has gone 897.54 miles ?

2. A rectangular field is 51.2 rods long and 42.5 rods wide. (*a*) How many square rods does it contain ? (*b*) How many acres are there in the field at 160 square rods to the acre ?

3. If a man can plow a field in 12.5 days, what decimal of the field can he plow in 1 day ?

4. How many days would a man require to plow a field if he plows .16 of it in 1 day ?

5. A can do .12 of a piece of work in a day, B can do .13 of it in a day, and C can do .15 of it in a day. (*a*) What decimal of it can all three do in a day ? (*b*) How many days would it take the three together to do the work ?

6. After selling 87.3 acres of land, Mr. Draper has 72.7 acres remaining. How many acres had he at first ?

7. How many miles would a train go in 12.8 hours at the rate of 42.5 miles per hour ?

8. How many hours would a train require to go 900 miles at the rate of 37.5 miles per hour ?

9. There are 3300 feet in $\frac{5}{8}$ mile. How many more inches are there in $\frac{5}{8}$ mile than in 1000 meters of 39.37 inches each ?

10. A man bought a horse for $240. He sold it at a profit of .15 times the cost. (*a*) What profit did he make ? (*b*) What was the selling price ?

11. A farmer bought a cow for $48. He sold it for $57.60. (*a*) What fraction of the cost was the profit ? (*b*) What decimal ? (*c*) What fraction of the selling price was the profit ?

Multiplying and Dividing by .5 and .25

Written Exercises

1. How much bread does a family use in a year if it averages per day (*a*) 2.5 lb. ?   (*b*) 3.25 lb. ?

PROCESS

a. 2.5 lb.	*b.* 3.25 lb.	In (*a*) use 2.5 as the mul-
× 365	× 365	tiplier. Multiply 365 by
182.5	91.25	.5 by dividing 365 by 2.
730	1095	In (*b*) multiply 365 by .25
Ans. 912.5 lb.	1186.25 lb.	by dividing 365 by 4.

---

2. Find products: *a.* 364 × .5.   *b.* 432 × 1.5.   *c.* 388 × .25.   *d.* 486 × 1.25.

3. Find quotients: *a.* 359 ÷ .5.   *b.* 297 ÷ .25.   *c.* 398 ÷ .25.   *d.* 486 ÷ .25.

Sight Exercises

1. A factory decreased the quantity of coal used per day from 2.8 tons to 2.3 tons.   (*a*) What decimal of a ton was saved per day?   (*b*) How many tons were saved in a year of 296 working days?   (*c*) How many tons are saved in the same period when the daily saving is .25 ton per day?

2. How many days are required to save 49 tons of coal when the daily saving is (*a*) .5 ton?   (*b*) .25 ton?

3. Give products:
   a. 84 × .5   *b.* .5 × 66   *c.* 48 × .25   *d.* .25 × 36

4. Give quotients:
   a. 84 ÷ .5   *b.* 91 ÷ .5   *c.* 42 ÷ .25   *d.* 31 ÷ .25

Denominate Numbers

Measures of Length

12 inches (in.)	1 foot (ft.)
3 feet	1 yard (yd.)
5½ yards	1 rod (rd.)
320 rods	1 mile (mi.)

Sight Exercises

1. How many inches are there in 1 yard?

2. How many feet are there in 1 rod?

3. How many yards are there (*a*) in 3 rods? (*b*) In 300 rods? (*c*) In 20 rods?

4. How many inches in 2 ft. 9 in.?

Measures of Weight

16 ounces (oz.)	1 pound (lb.)
2000 pounds	1 ton (T.)

NOTE. — Coal is sold at the mines by the *long ton* of 2240 pounds.
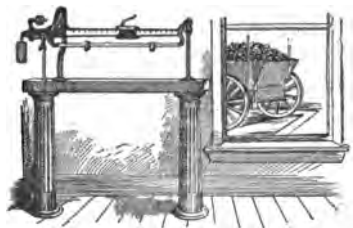
Sight Exercises

1. How many more pounds are there in a long ton than in a short one?

2. At the rate of 5 cents an ounce, what is the cost of a pound?

3. How many ounces are there in 10 lb. 5 oz.?

Measures of Time

60 seconds (sec.)	1 minute (min.)
60 minutes	1 hour (hr.)
24 hours	1 day (da.)
7 days	1 week (wk.)

Years and Months

Three years out of every four contain 365 days; the fourth which is called a *leap year*, contains 366 days. 1916 is a leap year; 1915, 1917, 1918 are ordinary years.

1916	FEBRUARY				1916
Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29				

A year (yr.) consists of 12 months (mo.). Four of the latter contain 30 days each. They are given in the old rhyme:

" Thirty days have September,
April, June, and November."

February has 29 days in leap year, and 28 days in other years. The other months have 31 days each.

Sight Exercises

1. Name the leap years from 1916 to 1940.

2. How many days in January and February, 1915?

3. How many days in February and March, 1916?

4. When Jan. 1 falls on Sunday, give the dates of the other Sundays in January?

5. How many minutes are there in $2\frac{1}{2}$ hours?

6. Change to the fraction of a minute: (a) 20 sec. (b) 30 sec. (c) 40 sec. (d) 45 sec. (e) 48 sec.

7. Change to the decimal of an hour: (a) 12 min. (b) 15 min. (c) 24 min. (d) 48 min. (e) 54 min.

8. How many days are there: (a) In 50 weeks? (b) In 2 weeks? (c) In 52 weeks?

Adding Compound Numbers

Preparatory Exercises

1. How many ounces are 12 ounces and 10 ounces?

2. How many pounds and ounces are 22 ounces?

3. How many pounds and ounces are 10 ounces and 12 ounces?

Sight Exercises

1. Give sums in pounds and ounces:

a.	13 oz.	*b.*	12 oz.	*c.*	10 oz.	*d.*	11 oz.	*e.*	14 oz.
	+ 9 oz.		+ 8 oz.		+ 10 oz.		+ 7 oz.		+ 9 oz.

2. Give sums in feet and inches:

a.	11 in.	*b.*	9 in.	*c.*	7 in.	*d.*	8 in.	*e.*	6 in.
	+ 6 in.		+ 10 in.		+ 11 in.		+ 10 in.		+ 9 in.

Written Exercises

1. Find the total weight of three hams, weighing respectively 13 lb. 8 oz., 16 lb. 9 oz., and 15 lb. 10 oz.

PROCESS

13 lb.	8 oz.	Write pounds under pounds and
16 lb.	9 oz.	ounces under ounces. Find the sum
15 lb.	10 oz.	of the ounces, 27 oz., change it to 1 lb.
Ans. 45 lb.	11 oz.	11 oz., and write 11 oz. under ounces. Carry 1 lb. to the pounds.

---

2. Add the following:

a.	17 lb. 9 oz.	*b.*	6 ft. 10 in.	*c.*	15 da. 20 hr.
	+ 13 lb. 12 oz.		+ 22 ft. 8 in.		+ 6 da. 10 hr.

d.	13 lb. 12 oz.	*e.*	22 ft. 8 in.	*f.*	6 da. 10 hr.
	+ 6 lb. 8 oz.		+ 39 ft. 5 in.		+ 23 da. 15 hr.

Subtracting Compound Numbers

Sight Exercises

Give remainders :

a.	17 lb. 10 oz.	*b.*	13 yr. 10 mo.	*c.*	10 wk. 6 da.
	− 5 lb.		− 8 yr.		− 7 wk.

d.	18 ft. 9 in.	*e.*	17 lb. 10 oz.	*f.*	13 yr. 10 mo.
	− 9 ft.		− 5 lb. 9 oz.		− 8 yr. 7 mo.

Written Exercises

1. A man began a piece of work at 7.45 A.M. How long did he take to do it if he completed it (*a*) at 11.50 A.M. ? (*b*) at 12 noon? (*c*) at 12.10 P.M. ?

PROCESS

b.	12 hr. (60)	*c.*	12 hr. 10 min. (70)
	− 7 hr. 45 min.		− 7 hr. 45 min.
Ans.	4 hr. 15 min.	*Ans.*	4 hr. 25 min.

In (*b*) think 45 min. and **15 min.** (writing 15 min.) are 1 hr. Carry 1 hr. to 7 hr., which makes 8 hr., etc.

---

2. Subtract :

a.	45 lb. 15 oz.	*b.*	32 yr. 11 mo.	*c.*	56 ft. 10 in.
	− 26 lb. 10 oz.		− 15 yr. 9 mo.		− 29 ft. 8 in.

d.	22 hr. 52 min.	*e.*	45 lb.	*f.*	32 yr. 6 mo.
	− 8 hr. 31 min.		− 26 lb. 10 oz.		− 15 yr. 9 mo.

Sight Exercises

Give remainders :

a.	18 lb. 2 oz.	*b.*	16 yr. 2 mo.	*c.*	17 wk. 3 da.
	− 8 lb.		− 7 yr.		− 5 wk.

d.	15 ft. 3 in.	*e.*	18 lb. 2 oz.	*f.*	16 yr. 2 mo.
	− 9 ft.		− 1 lb. 8 oz.		− 1 yr. 7 mo.

Multiplying Compound Numbers

Preparatory Exercises

1. At 4 ounces each, how many ounces will 3 packages of tea weigh?

2. If a box of candy weighs 8 ounces, (*a*) how many ounces will 2 boxes weigh? (*b*) How many pounds?

Sight Exercises

1. Give products:

a. 2 oz.	*b.* 1 lb. 2 oz.	*c.* 1 ft. 3 in.	*d.* 3 yd. 1 ft.
× 7	× 5	× 3	× 2
e. 4 oz.	*f.* 1 lb. 2 oz.	*g.* 1 ft. 3 in.	*h.* 1 yd. 1 ft.
× 4	× 8	× 4	× 3

Written Exercises

1. Find the length of 9 pieces of wire each measuring (*a*) 102 ft. 1 in. (*b*) 102 ft. 4 in. (*c*) 102 ft. 6 in.

PROCESS

a. 102 ft. 1 in.	*b.* 102 ft. 4 in.	*c.* 102 ft. 6 in.
× 9	× 9	× 9
Ans. 918 ft. 9 in.	*Ans.* 921 ft.	*Ans.* 922 ft. 6 in.

In (*b*) think 9 times 4 in. are 36 in., or 3 ft. Think 9 times 2 ft. are 18 ft.; carrying 3 ft. makes 21 ft.; etc.

In (*c*) think 9 times 6 in. are 54 in., or 4 ft. 6 in. Write 6 in. in its column, and carry 4 ft. to the product of 2 ft. by 9; etc.

---

2. Multiply:

a. 17 lb. 3 oz.	*b.* 13 da. 2 hr.	*c.* 25 ft. 1 in.
× 5	× 9	× 11
d. 17 lb. 4 oz.	*e.* 13 da. 4 hr.	*f.* 25 ft. 4 in.
× 4	× 6	× 3

Dividing Compound Numbers

Preparatory Exercises

1. When 12 ounces of tea are put into 3 equal packages, what is the weight of each?

2. How many ounces of candy does each receive when a pound is divided equally (*a*) between 2 children? (*b*) Among 4 children? (*c*) Among 8 children?

Sight Exercises

a. 4)1 lb.   *b.* 4)5 lb.   *c.* 4)1 lb. 4 oz.   *d.* 4)13 lb. 4 oz.

e. 4)2 lb.   *f.* 4)6 lb.   *g.* 4)2 lb. 4 oz.   *h.* 4)10 lb. 4 oz.

i. 4)1 da.   *j.* 4)6 da.   *k.* 4)1 da. 4 hr.   *l.* 4)13 da. 4 hr.

Written Exercises

1. A man divides a coil of wire into 9 equal portions. What is the length of each when the coil contains (*a*) 198 ft. 9 in.? (*b*) 201 ft.? (*c*) 202 ft. 6 in.?

PROCESS

a. 9)198 ft. 9 in.   *b.* 9)201 ft.   *c.* 9)202 ft. 6 in.
Ans. 22 ft. 1 in.   *Ans.* 22 ft. 4 in.   *Ans.* 22 ft. 6 in.

In (*b*) divide 201 ft. by 9, which gives a quotient of 22 ft. with 3 ft. remaining. Reduce 3 ft. to inches, which gives 36 inches. Divide 36 inches by 9, and write the quotient after 22 ft.

In (*c*) reduce the remainder 4 ft. 6 in. to 54 inches. Divide this by 9, and write the quotient 6 in. underneath the inches in the dividend.

---

2. Divide:

a. 6)81 lb.   *b.* 6)78 lb. 6 oz.   *c.* 7)71 lb. 5 oz.

d. 9)93 yd.   *e.* 7)98 ft. 7 in.   *f.* 8)97 yr. 4 mo.

Sight Problems

1. At $12 per month, what is the rent of a house for 3 yr. 7 mo.?

2. At the rate of 30 miles per hour, how far will a train go in 3 hr. 20 min.?

3. How many feet are there in the four sides of a rectangle 2 ft. 6 in. long, 1 ft. 6 in. wide?

4. From a piece of cloth 10 yards long, a dealer sold 6 yd. 1 ft. How much remained?

5. John is 16 yr. 8 mo. old; James is 1 yr. 8 mo. older than John. How old is James?

6. At $\frac{3}{4}$ inch each, how many nails can be made from a foot of wire?

7. Mr. Brown's age is 48 yr. 4 mo., Mrs. Brown's 40 yr. 6 mo. What is the difference in their ages?

8. If it takes 4 ft. 6 in. of ribbon to trim a hat, (*a*) how many feet will be required to trim a dozen hats? (*b*) How many yards?

9. Find the cost of 4 ft. 6 in. at 60 cents per yard.

10. A train leaves X at 9.20 A.M. and reaches Y at noon. How long does it require to take the trip?

11. When a train takes 3 hr. 20 min. to go 100 miles, how many miles does it average per hour?

12. (*a*) How many rods are there in $\frac{5}{8}$ mile? (*b*) How many yards?

13. It takes 1 mile of fencing to enclose a square field. Find the length of each side in rods.

14. Change 3600 pounds (*a*) to tons and pounds. (*b*) To tons and the fraction of a ton. (*c*) To tons and the decimal of a ton.

Written Problems

1. At $48 per month, what is the rent of a house for 3 yr. 7 mo.?

2. How far will a train go in 3 hr. 45 min. at the rate of 36 miles per hour?

3. How many feet are there in the three sides of a triangle which measure, respectively, 13 ft. 9 in., 13 ft. 9 in., and 12 ft. 6 in.?

4. From a piece of cloth 40 yards long, a dealer sold 3 pieces each measuring 4 yd. 2 ft. How many yards remained?

5. William is 16 yr. 8 mo. old. Mary is 1 yr. 8 mo. older than William. Find the sum of their ages.

6. At $\frac{3}{4}$ inch each, how many nails can be made from 12 ft. 3 in. of wire?

7. Mr. Smith is 48 yr. $4\frac{1}{2}$ mo. old; Mrs. Smith is 39 yr. $6\frac{3}{4}$ mo. old. Find the difference in their ages.

8. If it requires 2 ft. 9 in. of ribbon to trim a jacket, (*a*) how many feet will it require for 4 dozen jackets? (*b*) How many yards?

9. Find the cost of 2 ft. 8 in. at $1.26 per yard.

10. A train leaves P at 8.47 A.M. and is due at Q at noon. (*a*) How long is it allowed for the trip? (*b*) How much time does it take when it is delayed 2 hr. 30 min.?

11. When a train takes 13 hr. 45 min. to go 550 miles, how many miles does it average per hour?

12. (*a*) How many rods are there in 8 miles? (*b*) How many yards?

13. The perimeter of a square field is 2 miles 84 rods; what is the length of each side in rods?

Areas of Rectangles

Preparatory Exercises

1. How many panes of glass are there in a window that has 3 panes in its width and 4 in its length?

2. How many square inches are there in a rectangle 4 inches long and 3 inches wide?

3. Measure the top of your desk and calculate the number of square inches in its surface.

4. What measurements must you make to find out the number of square feet in the floor of the classroom?

Written Exercises

1. How many square feet are there in a piece of carpet 22 ft. 8 in. long, 16 ft. 6 in. wide?

PROCESS

As the area is required in square feet, express each dimension in feet.

22 ft. 8 in. = $22\frac{2}{3}$ ft.   16 ft. 6 in. = $16\frac{1}{2}$ ft.

Area in square feet = $22\frac{2}{3}$ (ft.) × $16\frac{1}{2}$ (ft.)

$22\frac{2}{3} \times 16\frac{1}{2} = \frac{68}{3} \times \frac{33}{2}$.   Cancel.

NOTE. — The length and the width of a rectangle are called its *dimensions.*

2. Give the area in square feet of rectangles whose dimensions are, respectively :

    a. 18 ft. 9 in. by 12 ft. 9 in.   *b.* 10′ 4″ × 16′ 6″

    c. 10′ 10″ × 5′ 4″   *d.* 12 ft. 9 in. by 10 ft. 8 in.

The signs ′ and ″ are used to express feet and inches, respectively. Thus, 16′ 6″ is read 16 feet 6 inches. The sign × meaning "by" is frequently placed between the dimensions. Thus, 16′ 6″ × 13′ 4′ is read 16 feet 6 inches by 13 feet 4 inches.

Written Exercises

1. (*a*) How many square rods are there in a field $37\frac{1}{2}$ rods long, $25\frac{2}{3}$ rods wide ? (*b*) At 160 square rods to the acre, how many acres does it contain ? (*c*) What did it cost at $75 per acre ?

2. (*a*) How many rods of fencing will be required to enclose a field 37.5 rods long, 25.6 rods wide ? (*b*) At $2 per rod what will be the cost of the fence ?

3. How many square feet are there in a strip of hall carpet 8 yards long, $\frac{3}{4}$ yard wide ?　·

4. Change 54 inches (*a*) to yards and a fraction. (*b*) To yards and a decimal.

5. (*a*) How many square yards are there in a piece of oilcloth 24 feet long, 54 inches wide. (*b*) What would it cost at 75 cents per square yard ?

6. A box of glass contains 50 square feet. How many panes of glass does it contain when each pane measures $\frac{1}{2}$ ft. by $\frac{2}{3}$ ft. ?

7. Measure a blackboard in the classroom, and find its cost at 60 cents a square yard.

8. Measure a pane of glass in a window of the classroom and (*a*) find the number of square inches it contains. (*b*) Find the total number of square inches in all the panes of one window.

NOTE. — In measuring a pane of glass allow for the portion of the glass that is covered by the putty.

9. Measure the floor of the classroom, and calculate the number of square feet it contains.

10. Find the number of square feet (*a*) in the north wall of the classroom. (*b*) In the south wall. (*c*) In the west wall. (*d*) In the east wall.

Volumes of Rectangular Solids

Preparatory Exercises

1. The top layer of a box of caramels has 4 rows of 6 caramels each. (*a*) How many caramels are there on the top layer? (*b*) On the bottom layer? (*c*) How many caramels does the box contain if there are 3 layers?

2. How many 1-inch cubes could be placed in a box 6 inches long, 5 inches wide, 4 inches deep, inside measurement?

3. What is the capacity of a box 4 feet long, 3 feet wide, 2 feet deep?

Written Exercises

1. A freight car is 32 feet long and 8 feet wide. If it is loaded with grain to the depth of 5 feet, how many cubic feet of grain does it contain?

PROCESS

32 (ft.) × 8 (ft.) × 5 (ft.) = 1280 (cu. ft.).   The number of cubic feet is equal to the continued product of the number of feet in the length multiplied by the number of feet in the width multiplied by the number of feet in the depth.

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2. When a cubic foot will hold $\frac{4}{5}$ bushel, how many bushels of wheat are there (*a*) in 1280 cubic feet? (*b*) In 1600 cubic feet?

3. (*a*) How many cubic feet of corn are there in a corn-crib 16 feet long, 10 feet wide, when the corn is 10 feet deep? (*b*) How many bushels of ear corn are there in the crib at $\frac{4}{5}$ bushel to the cubic foot? (*c*) If 2 bushels of corn in the ear make 1 bushel of shelled corn, how many bushels of shelled corn does the crib contain?

Reviews

Reading and Writing Numbers — Roman Notation

The Romans used I, V, X, L, C, D, and M to indicate, respectively: one, five, ten, fifty, one hundred, five hundred, and one thousand. Their method of expressing other numbers is shown in the following:

TABLE

One I	Ten X	One Hundred C
Two II	Twenty XX	Two Hundred CC
Three III	Thirty XXX	Three Hundred CCC
Four IV	Forty XL	Four Hundred CD
Five V	Fifty L	Five Hundred D
Six VI	Sixty LX	Six Hundred DC
Seven VII	Seventy LXX	Seven Hundred DCC
Eight VIII	Eighty LXXX	Eight Hundred DCCC
Nine IX	Ninety XC	Nine Hundred CM

To express numbers between ten and twenty, twenty and thirty, etc., annex to X, XX, etc., the characters representing the numbers one to nine. To express numbers between one hundred and two hundred, two hundred and three hundred, etc., annex to C, CC, CCC, etc., the characters representing the numbers from one to ninety-nine.

1. Read the following:

a. XVIII	*b.* CCCXIX	*c.* MDCC	*d.* MDCCVI
e. XXXIV	*f.* DCLVII	*g.* MCM	*h.* MCMXV
i. XLIX	*j.* DCCCL	*k.* MCDL	*l.* MCDLX
m. LXXIV	*n.* CDIX	*o.* MCMX	*p.* MCML
q. XCIX	*r.* CMXIV	*s.* MDCX	*t.* MDCCXL

2. Write in Roman numbers:

a. 25	*b.* 470	*c.* 478	*d.* 1,205	*e.* 1,111
f. 74	*g.* 650	*h.* 605	*i.* 1,407	*j.* 1,333

Arabic Numbers

1. Read 30 000 607 089.

For convenience in reading large numbers, divide them by commas into periods of three figures each, beginning at the right.

The names of the periods are given in the following

TABLE

	Billions	Millions	Thousands	Ones
	30,	000,	607,	089

To read a number begin at the highest period and read separately the number constituting each period. To each period but the last affix the name of the period. Ignore a period consisting entirely of ciphers.

The foregoing number is read : 30 billion, 607 thousand, 89.

NOTE. — Do not use " and " in reading whole numbers.

2. Read the following :

a.	1,307	b.	1,256,450	c.	2,104,306,729
d.	25,004	e.	370,607	f.	16,045,290,010
g.	163,400	h.	38,547,623	i.	4,004,004,004
j.	47,050	k.	7,056,008	l.	370,056,030

Writing Numbers

1. Write 15 billion, 674.

As the billions' period is the fourth, insert three ciphers for each of the two missing periods.

2. Write 216 million, 14 thousand.

Affix three ciphers for the missing ones' period. Prefix a cipher to 14 in the second period.

Sight Problems

1. Find the cost of a pair of shoes at $3.50 and a hat at $1.80.

Think three fifty and one eighty. Omit the words *dollars* and *cents* in giving oral answers.

2. How much change out of $10 is received by the purchaser of articles costing $5.40?

3. How old in 1915 is a boy born in 1904?

4. In 1915 a girl is 16 years old. In what year was she born?

5. A man's yearly salary was $2050. He spent $1650. How many dollars did he save?

6. Two trains start at the same time from the same point and go in opposite directions. If one goes 44 miles in an hour, and the other 48 miles, how far apart are they (*a*) in 1 hour? (*b*) In two hours?

7. Two trains start at the same time from cities 200 miles apart and go towards each other. How far apart are they when one goes 32 miles and the other 34 miles?

8. What is the perimeter of a rectangle 28 rods long 18 rods wide?

9. A machine threshed in a day 800 bushels of oats and 430 bushels of wheat. How many bushels of grain did it thresh in a day?

10. How many men are there in an army when there are 20,000 in the infantry, 7000 in the cavalry, 3000 in the artillery, and 1000 others?

11. A barrel filled with cement weighs 404 pounds. The barrel weighs 24 pounds. What is the weight of the cement?

Addition and Subtraction

Written Exercises

1. Mr. A bought goods during January to the following amounts:

$57.81, $505, $98.87, $47.64, $0.88, $5.43, $677.42, $98.89, $6.64, and $175.53.

What was the total amount of his January purchases?

2. Add the following. Test.

a. 3783 lb., 59,046 lb., 763,750 lb., 654,528 lb., 9876 lb., 605,231 lb., 67,899 lb., 8500 lb., 4095 lb., and 387 lb.

b. $58, $346.75, $88.77, $1909.36, $4687.34, $504.02, $1986.35, $0.85, $675.98, and $2345.67.

3. Mrs. B has $480. How much will she have after paying bills of $34.78, $65.43, $176.39, and $79.44?

PROCESS

$480.
  34.78
  65.43
 176.39
  79.44
$123.96 *Ans.*

Think 13, 16, 24, and **6** (writing 6) are 30.

Think 7, 10, 14, 21, and **9** (writing 9) are 30.

Think 12, 18, 23, 27, and **3** (writing 3) are 30.

Think 10, 17, 23, 26, and **2** (writing 2) are 28.

Think 3 and **1** (writing 1) are 4.

Test by covering the minuend, $480, with a piece of paper. Write on this the sum of the remainder and the subtrahends adding downwards.

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4. From 12,345 take the sum of 3478, 654, 936, and 895.

5. From 6803 take the sum of 478, 654, 2176, 639, and 1234.

Multiplying by $12\frac{1}{2}$, 25, 50

Preparatory Exercises

1. What is (*a*) $\frac{1}{2}$ of 100?   (*b*) $\frac{1}{4}$ of 100?   (*c*) $\frac{1}{8}$ of 100?

2. What part of 100 is (*a*) 50?   (*b*) 25?   (*c*) $12\frac{1}{2}$?

3.   *a.* $50 \div 100 = ?$ *b.* $12\frac{1}{2} \div 100 = ?$
                c. $25 \div 100 = ?$

4.   *a.* $12\frac{1}{2} = \dfrac{100}{?}$ *b.* $25 = \dfrac{100}{?}$ *c.* $50 = \dfrac{100}{?}$

5. Multiply.   First cancel 24 and the denominator of each fraction.

a. $24 \times \dfrac{100}{2}$ *b.* $24 \times \dfrac{100}{8}$ *c.* $24 \times \dfrac{100}{4}$

6. Give products: !

a. 25×24	*b.* 50×24	*c.* $12\frac{1}{2} \times 24$	*d.* 24×25
e. 25×48	*f.* 50×48	*g.* $12\frac{1}{2} \times 48$	*h.* 36×25
i. 25×26	*j.* 50×27	*k.* $12\frac{1}{2} \times 96$	*l.* 50×96
m. 25×64	*n.* 50×86	*o.* $12\frac{1}{2} \times 64$	*p.* 96×25

Sight Problems

1. At 3 pairs for $1, what will be the cost of 24 pairs of stockings?

2. Find the area of a piece of ground 25 feet wide, 124 feet long.

3. At 48 bushels per acre, how many bushels of corn will $12\frac{1}{2}$ acres yield?

4. How many miles will a train go in 18 hours at the rate of 25 miles per hour?

5. At 25 cents per hour, how much will a man earn in 6 days of 8 hours each?

Written Exercises

1. Find the area of a rectangle 264 yards long, when its width is (*a*) 12½ yards? (*b*) 25 yards? (*c*) 50 yards?

SUGGESTION. — Write the examples as shown below. Mentally affix two ciphers to the multiplicand. Divide the new multiplicand (*a*) by 8, (*b*) by 4, and (*c*) by 2, respectively.

<div style="border:1px solid">

PROCESS

a	*b*	*c*
264	264	264
× 12½	× 25	× 50

Ans.   3300 (sq. yd.)   6600 (sq. yd.)   13,200 (sq. yd.)

Test the results by rejecting two ciphers and multiplying by 8, by 4, and by 2, respectively.

</div>

2. Multiply by 25 : *a.* 136.   *b.* 256.   *c.* 332.   *d.* 464.

3. Multiply by 12½ : *a.* 136.   *b.* 256.   *c.* 336.   *d.* 464.

4. Multiply by 50 : *a.* 136.   *b.* 256.   *c.* 336.   *d.* 474.

Written Problems

1. At $3 per dozen pairs, what will be the cost of 42 pairs of socks?

2. Find the area of a building lot 25 feet by 138 feet.

3. At 46 bushels per acre, how many bushels of corn would 112½ acres yield?

4. How many miles could a steamer go in a week at the rate of 25 miles per hour?

5. At 25 cents per hour, how much could a man earn in a year of 309 working days if he worked 8 hours per day?

6. At 12½ cents per pound, find the value of 8 chickens averaging 7½ pounds each.

Dividing by 50, 25, $12\frac{1}{2}$

Preparatory Exercises

1. What part of 100 is (*a*) 50 ?   (*b*) 25 ?   (*c*) $12\frac{1}{2}$?

2. *a.* $50 = 100 \times$?   *b.* $25 = 100 \times$?   *c.* $12\frac{1}{2} = 100 \times$?

3. *a.* $50 + 100 =$?   *b.* $25 + 100 =$?   *c.* $12\frac{1}{2} + 100 =$?

Sight Exercises

1. How long will it require a man to travel 675 miles at the rate of (*a*) 25 miles per hour?   (*b*) $12\frac{1}{2}$ miles? (*c*) 50 miles ?

Divide the dividend and the divisor by 100. This makes the former $6\frac{3}{4}$ in each case, and the latter $\frac{1}{2}$, $\frac{1}{8}$, and $\frac{1}{4}$, respectively. Divide the new dividend by the new divisor; that is, multiply the former by the latter inverted; 4, 8, 2, respectively.

2. Divide 3025 (*a*) by 25.   (*b*) By $12\frac{1}{2}$.   (*c*) By 50.

3. Divide 1250 (*a*) by 50.   (*b*) By 25.   (*c*) By $12\frac{1}{2}$.

4. Divide 2175 (*a*) by 50.   (*b*) By 25.   (*c*) By $12\frac{1}{2}$.

Sight Problems

1. A row of houses extends 800 feet along a street. How many houses are there when each is (*a*) 20 feet wide?   (*b*) 25 feet wide ?

2. When the average yield per acre is 25 bushels, how many acres will yield 925 bushels ?

3. A drover paid $1125 for 25 cows; what was the average price ?

4. A rectangular field contains 2225 square rods.   Its width is 25 rods.   What is its length ?

Written Exercises

1. How many acres will yield 2450 bushels of grain when the yield per acre is (*a*) $12\frac{1}{2}$ bushels? (*b*) 25 bu.? (*c*) 50 bu.?

ANALYSIS

(*a*) $2450 \div 12\frac{1}{2} = 24\frac{1}{2} \div \frac{1}{8} = 24\frac{1}{2} \times 8 = 196$ (A.). *Ans.*

(*b*) $2450 \div 25\ \ = 24\frac{1}{2} \div \frac{1}{4} = 24\frac{1}{2} \times 4 = \ \ 98$ (A.). *Ans.*

(*c*) $2450 \div 50\ \ = 24\frac{1}{2} \div \frac{1}{2} = 24\frac{1}{2} \times 2 = \ \ 49$ (A.). *Ans.*

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2. Divide by $12\frac{1}{2}$: *a.* 2700. *b.* 3850. *c.* 4300. *d.* 5550. *e.* 6200.

3. Divide by 25: *a.* 2900. *b.* 3650. *c.* 4400. *d.* 5350. *e.* 6400.

4. Divide by 50: *a.* 2700. *b.* 3950. *c.* 4700. *d.* 5750. *e.* 6900.

Written Problems

1. At 25 passengers to a boat, how many lifeboats would carry 675 passengers?

2. How many acres would be required to produce 2125 bushels of wheat at the rate of 25 bushels to the acre?

3. At 50 pounds to the bushel, what is the weight of 47 bushels of apples?

Sight Problems

1. If a cow gives 750 pounds of milk during June, what is the average per day?

2. If $\frac{1}{25}$ of the milk is butter fat, how many pounds of butter fat are contained in 750 pounds of milk?

3. At $1.50 per week for feed and labor, what is the cost of keeping a cow for 52 weeks?

Inexact Division

Preparatory Exercises

1. If 51 marbles are divided among 6 boys, how many marbles will each receive?

2. What is the average price of a pig when 6 pigs cost $51?

3. How many hens can be properly accommodated in a pen containing 51 square feet, if each hen requires 6 square feet?

4. How many trips must a lifeboat make to bring ashore 51 passengers if 6 can be taken on each trip?

Although each of the foregoing questions involves the division of 51 by 6, each answer differs from the others. To the first, the answer should indicate that there are 3 marbles left after the division is made; the answer to the second is $8½; to the third, the answer is 8 hens, no reference being necessary to the three extra square feet; to the fourth, the answer is 9 trips.

Written Problems

1. At $6 each, how many pigs can be bought for $500?

2. If each pupil requires 18 square feet of floor space, how many pupils can be properly accommodated in a class-room 25 feet long and 24 feet wide?

3. When a lifeboat can carry 24 persons, how many boats are required to carry 500 persons?

4. A farmer raised 500 bushels of wheat on a field of 40 acres. What was the average yield per acre?

5. How many men must be hired to do a piece of work in 16 days if 1 man would require 500 days to do it?

6. What is the average number of pupils to a class when 16 classes contain 500 pupils?

NOTE. — In giving *averages*, express fractions of pupils, etc.

Indicating Operations

Preparatory Exercises

1. A boy spends 100 cents for a baseball suit, 20 cents for a ball, and 5 cents for a bat. How much did he spend in all?

The operation required to solve this problem may be indicated by signs as follows:

(*a*) Total cost in cents = 100 + 20 + 5.

2. How many cubic feet of water are there in a swimming pool 100 feet long and 20 feet wide, when the water is 5 feet deep?

(*b*) Number of cubic feet = 100 × 20 × 5.

3. How much money would a girl have out of 100 cents if she paid 20 cents for yarn and 5 cents for needles?

If she bought the yarn in one store and the needles in another, the operations could be indicated thus:

(*c*) Number of cents remaining = (100 − 20) − 5.

If she bought both in one store, the operations might be expressed in this form:

(*d*) Number of cents remaining = 100 − (20 + 5).

Note. — A parenthesis indicates that the numbers it encloses are to be combined before combining them with the others.

4. If a man pays 100 cents for 20 bags of marbles, each containing 5 marbles, what is the price of one marble?

If the cost of a bag is first found, and then divided by the number of marbles, the operations could be indicated thus:

Cost of a marble in cents = (100 ÷ 20) ÷ 5.

If the total cost is divided by the number of marbles, the operations might be given in this form:

Cost of a marble in cents = 100 ÷ (20 × 5).

Sight Exercises

1. Give answers:

a. $100 + 20 + 5$ b. $(100 + 20) + 5$ c. $100 + (20 + 5)$

d. $100 \times 20 \times 5$ e. $(100 \times 20) \times 5$ f. $100 \times (20 \times 5)$

g. $100 - 20 - 5$ h. $(100 - 20) - 5$ i. $100 - (20 - 5)$

j. $100 \div 20 + 5$ k. $(100 \div 20) \div 5$ l. $100 \div (20 \div 5)$

2. What answers are the same in the first line? In the second? In the third? In the fourth?

3. How do the answers in the first column compare with those (a) in the second? (b) In the third?

4. Give answers:

a. $100 + 20 \times 5$ b. $100 + (20 \times 5)$ c. $(100 + 20) \times 5$

d. $100 - 20 \times 5$ e. $100 - (20 \times 5)$ f. $(100 - 20) \times 5$

g. $100 + 20 \div 5$ h. $100 + (20 \div 5)$ i. $(100 + 20) \div 5$

j. $100 - 20 \div 5$ k. $100 - (20 \div 5)$ l. $(100 - 20) \div 5$

Order of Signs

While it is agreed among mathematicians that in such examples as those in the first column the multiplication or division must first be performed before the additions or subtractions are made, it is better to show this in each case by the use of a parenthesis, as in the second column, in which the answers are the same as those in the first.

Written Exercises

Find answers:

a. $24\frac{1}{2} + 16\frac{2}{3} + 7\frac{5}{6}$ b. $(15\frac{1}{2} + 40\frac{1}{4}) \times 12\frac{1}{2}$

c. $35\frac{2}{3} - 14\frac{1}{4} - 6\frac{3}{8}$ d. $(24\frac{1}{2} + 16\frac{2}{3}) \div 13\frac{3}{4}$

e. $12\frac{1}{2} \times 10\frac{2}{5} \times 8\frac{3}{10}$ f. $(10\frac{1}{2} \div 12\frac{1}{4}) + 52\frac{5}{6}$

g. $48\frac{1}{3} + 18\frac{3}{4} - 4\frac{5}{9}$ h. $(89\frac{1}{2} \div 17\frac{1}{2}) - 4\frac{2}{7}$

Preparatory Exercises

1. Find the cost of 8 cows at $50 each; *i.e.* $8 \times \$50 = ?$

2. How much is paid for 8 cows at $50 each and 4 horses at $200 each?

$$(8 \times \$50) + (4 \times \$200)$$

3. How much more than $1000 will be the total cost of 8 cows at $50 each and 4 horses at $200 each?

$$[(8 \times \$50) + (4 \times \$200)] - \$1000$$

4. Mrs. Griffin has $2000. How many dollars will she have after paying for 8 cows at $50 each and 4 horses at $200 each?

$$\$2000 - [(8 \times \$50) + (4 \times \$200)]$$

5. Mr. Ziegler spent $12,000, paying $10,000 for a farm, $50 each for 8 cows, $200 each for 4 horses, and the remainder for machinery, tools, etc. What did the machinery, etc., cost him?

$$\$12,000 - [\$10,000 + (8 \times \$50) + (4 \times \$200)]$$

6. Mrs. Collins bought 100 acres of land at $100 per acre; tools, machinery, etc., to the amount of $800; 8 cows at $50 each; and 4 horses. If the total cost was $12,000, how much apiece did the horses cost?

$$\frac{\$12,000 - [(100 \times \$100) + \$800 + (8 \times \$50)]}{4}$$

Indicate division by writing the divisor below a horizontal line.

7. Mr. Kelly sold his farm, implements, stock, etc., for $12,000. He obtained $50 apiece for his 12 cows, $150 apiece for his 4 horses, $600 for his implements, and the remainder for the land, 120 acres. What did the land bring per acre?

Written Problems

Before working the following problems, indicate the operations required for their solution, omitting the denominations; cents, pupils, etc.

1. After spending 75 cents for a ball and 15 cents for a bat, John still had 5 cents. How much money had he at first ?

2. There were 75 pupils in a school on the opening day. During the month 15 new pupils entered and 4 old pupils left. How many pupils were there in the school at the end of the month ?

3. A man raised 75 tons of hay on 5 fields. How many tons did he raise to the acre if each field contained 15 acres ?

4. At $5 each how many pigs should be exchanged for a cow worth $75 and a calf worth $15 ?

5. A man had 75 head of cattle. He sold 15 head and divided the remainder among his 5 sons. What was the share of each ?

6. At 15 bushels to the acre, what is the yield of 5 fields each containing 75 acres ?

7. After buying 15 acres of land at $75 per acre a man still has $5. How much had he at first ?

8. To buy 5 cows at $75 each a man needs $15 more. How much money has he ?

9. A man exchanged 15 acres of land at $75 per acre for pigs at $5 each. How many pigs did he get ?

10. A dealer sold 75 sheep to A and 15 to B. How much did he receive if the sheep brought $5 each ?

11. A girl has saved 75 cents. How much will she have after spending 15 cents for a reader and 5 cents for a pencil ?

DECIMALS, DENOMINATE NUMBERS, MEASUREMENTS,
REVIEWS, SHORT METHODS, BILLS AND RECEIPTS

Decimals — Three Places

Preparatory Exercises

1. How do you read (*a*) .1 ?   (*b*) .01 ?

2. What is the effect in (*b*) of the prefixed decimal cipher?

The expression $12.345 is read 12 dollars 34 cents and 5 mills.

3. A mill is one tenth of a cent.   (*a*) What part of 1 dime is 1 mill?   (*b*) What part of $1 is 1 mill?

Reading Decimals

Decimals of three places are read as *thousandths.*

The number 12.345 is read 12 and 345 thousandths; .023 is read 23 thousandths; 1.006 is read 1 and 6 thousandths.

Sight Exercises

Read the following:

a. 3.4	*b.* 2.34	*c.* 1.02	*d.* .102	*e.* 1.023	*f.* 4.001
g. 4.5	*h.* 3.45	*i.* 2.03	*j.* .203	*k.* 2.034	*l.* 5.002
m. 5.6	*n.* 4.56	*o.* 3.04	*p.* .304	*q.* 3.045	*r.* 6.003
s. 6.7	*t.* 5.67	*u.* 4.05	*v.* .405	*w.* 4.056	*x.* 7.004

Written Exercises

1. Write in the form of a decimal :

$a.\ \frac{1}{10}$ $b.\ \frac{25}{100}$ $c.\ \frac{8}{100}$ $d.\ \frac{1}{1000}$ $e.\ \frac{27}{1000}$ $f.\ \frac{127}{1000}$

$g.\ \frac{5}{10}$ $h.\ \frac{27}{100}$ $i.\ \frac{7}{100}$ $j.\ \frac{8}{1000}$ $k.\ \frac{88}{1000}$ $l.\ \frac{238}{1000}$

$m.\ \frac{8}{10}$ $n.\ \frac{75}{100}$ $o.\ \frac{8}{100}$ $p.\ \frac{7}{1000}$ $q.\ \frac{65}{1000}$ $r.\ \frac{845}{1000}$

2. Express as decimals of a dollar :

a. 3 dimes	*b.* 13 cents	*c.* 2 cents	*d.* 5 mills
e. 7 dimes	*f.* 22 cents	*g.* 5 cents	*h.* 7 mills
i. 1 dime	*j.* 57 cents	*k.* 8 cents	*l.* 9 mills
m. 9 dimes	*n.* 68 cents	*o.* 6 cents	*p.* 3 mills

q. 3 cents 5 mills   *r.* 1 cent 3 mills

s. 3 dimes 5 mills   *t.* 1 dime 3 mills

Comparisons

Preparatory Exercises

Express as common fractions in lowest terms :

1. *a.* 5 tenths *b.* 50 hundredths *c.* 500 thousandths

2. *a.* 2 tenths *b.* 20 hundredths *c.* 200 thousandths

Sight Exercises

1. Compare the following sets :

a. .5, .50, and .500 *b.* .3, .30, and .300 *c.* .4, .40, and .400

2. What is the effect of writing one or more ciphers at the right of a decimal?

3. Compare the following sets :

a. .1 and .01   *b.* .01 and .001   *c.* .1 and .001

d. .5 and .05   *e.* .05 and .005   *f.* .5 and .005

4. What is the effect of prefixing (*a*) one decimal cipher? (*b*) Two decimal ciphers?

Adding and Subtracting Decimals

5. (*a*) B is 5.04 miles east of A. C is 4.26 miles east of B. How many miles is C from A?

(*b*) C is 9.3 miles east of A. B is 5.04 miles east of A. How far is it from B to C?

$$A \overline{\underset{5.04 \text{ mi.} \quad B \ 4.26 \text{ mi.}}{\overset{9.3 \text{ mi.}}{}}} C$$

	PROCESS	
a	To add or to subtract decimals, write the deci-	*b*
5.04 mi.	mal points in the same	9.3 mi.
+4.26	vertical line. Omit ter-	−5.04
Ans. 9.3 mi.	minal decimal ciphers.	*Ans.* 4.26 mi.

6. Give answers:

a. 4.5	*b.* 3.25	*c.* 5.004	*d.* 2.89	*e.* 2.009
+.6	+ 1.5	+ .6	+ 3.107	+ 3.021

Subtract:

f. 4.5	*g.* 3.25	*h.* 5.004	*i.* 3.89	*j* . 3.021
−.6	− 2.5	− .6	− 2.108	− 2.009

Written Exercises

1. A mark is worth $.238 and a franc is worth $.193. What is the total value of the two coins?

2. Add the following:

a.   3.47 + .375 + 2.5 + 46.05 + 11.7 + 8.18

b.   12.25 + 5.76 + 83.64 + 4.068 + 18.235

3. Find the difference in our money between the value of a mark and that of a franc.

Multiplying Decimals

Preparatory Exercises

1. Multiply by 3: *a.* 1 tenth. *b.* 11 hundredths.
c. 13 thousandths. *d.* 1 and 1 tenth. *e.* 2 and 3 hundredths. *f.* 4 and 7 thousandths.

2. Give products:

a. .1	*b.* .3	*c.* .07	*d.* .13	*e.* .7	*f.* 3.2
× 3	× 3	× 3	× 3	× 3	× 4

In the product of two decimals, point off as many decimal places as there are decimal places in the multiplier and the multiplicand together.

Written Exercises

1. How far will a train travel in 6.4 hours at the rate of 32.15 miles per hour?

	PROCESS	TEST
32.15 mi.	Omit the decimal point in the	32.15
× 6.4	partial products. Point off three	× 8
12860	(2+1) places in the product. Can-	257.2
19290	cel the terminal decimal cipher.	× .8
Ans. 205.76̸ mi.	Test by multiplying 32.15 by 8, and this product by .8.	205.76

NOTE. — In multiplying decimals, as in all other arithmetical operations, examine the reasonableness of the answer. A pupil that notes that 6 times 32 is nearly 200 will not write the answer as 20.576 or 2057.6.

2. Find products:

a. 3.508 × 8 *b.* 3508 × 8.1 *c.* 35.08 × 8.3 *d.* 3.508 × 85
e. 2.345 × 7 *f.* 2345 × 7.2 *g.* 23.45 × 7.3 *h.* 2.345 × 74
i. 4.062 × 9 *j.* 4003 × 9.7 *k.* 40.64 × 9.8 *l.* 4.066 × 96

Division — Decimal in Quotient

Written Exercises

1. (*a*) At \$125 per acre, how many acres of land will cost \$10,507? (*b*) How many cords of wood, at 128 cubic feet to the cord, are there in a pile of wood containing 720 cubic feet?

	a	PROCESS	*b*
Ans.	84.056 (A.)		*Ans.* 5.625 (cords)

$$125\overline{)10507.}$$
$$\underline{1000}$$
$$507$$
$$\underline{500}$$
$$\overline{700}$$
$$\underline{625}$$
$$\overline{750}$$
$$\underline{750}$$

$$128\overline{)720.}$$
$$\underline{640}$$
$$\overline{800}$$
$$\underline{768}$$
$$\overline{320}$$
$$\underline{256}$$
$$\overline{640}$$
$$\underline{640}$$

Place a decimal point in the quotient when it is reached in performing the division, and continue the latter, annexing decimal ciphers to the partial dividends as may be required.

Test by multiplying the quotient by the divisor.

2. Find answers:

a. $196 \div 32$ *b.* $42.6 \div 24$ *c.* $1.359 \div 9$ *d.* $6.5 \div 125$
e. $520 \div 64$ *f.* $72.6 \div 15$ *g.* $3.008 \div 8$ *h.* $9.6 \div 128$

Reductions

Sight or Written Exercises

1. Express in lowest terms:

a. $\frac{4}{10}$ *b.* $\frac{4}{100}$ *c.* $\frac{25}{100}$ *d.* $\frac{4}{1000}$ *e.* $\frac{25}{1000}$ *f.* $\frac{125}{1000}$
g. $\frac{2}{10}$ *h.* $\frac{5}{100}$ *i.* $\frac{32}{100}$ *j.* $\frac{5}{1000}$ *k.* $\frac{32}{1000}$ *l.* $\frac{375}{1000}$

Sight or Written Exercises

1. Change $\frac{7}{125}$ to a decimal.

PROCESS

$$\begin{array}{r} .056 \text{ } Ans. \\ 125\overline{)7.00} \\ 6\,25 \\ \hline 750 \\ 750 \\ \hline \end{array}$$

Since $\frac{7}{125}$ indicates that 7 is to be divided by 125, perform the division. Place a decimal point in the quotient over the decimal point in the dividend. As 70 does not contain 125, place a cipher over the 0, and take 700 for the first partial dividend.

2. Reduce to a decimal:

a. $\frac{1}{25}$ *b.* $\frac{8}{125}$ *c.* $\frac{17}{125}$ *d.* $\frac{23}{125}$ *e.* $\frac{107}{125}$ *f.* $\frac{118}{125}$

3. Express as a common fraction in lowest terms:

a. .036   *b.* .135   *c.* .027

PROCESS

a. $.036 = \frac{36}{1000} = \frac{9}{250}$. *Ans.*

b. $.135 = \frac{135}{1000} = \frac{27}{200}$. *Ans.*

c. $.027 = \frac{27}{1000}$. *Ans.*

Write each in the form of a common fraction and reduce to lowest terms by dividing the numerator and the denominator by the same number; 2, 4, 8; 5, 25, 125.

NOTE. — A fraction having 10, 100, or 1000 for its denominator can be reduced to lower terms only when its numerator is either an even number, or terminates in 5.

4. Change to common fractions in lowest terms:

a. .062 *b.* .065 *c.* .068 *d.* .064 *e.* .069 *f.* .008
g. .012 *h.* .015 *i.* .024 *j.* .025 *k.* .123 *l.* .234

5. Express as the fraction of a dollar:

a. 2 mills   *b.* 3 mills   *c.* 4 mills   *d.* 5 mills
e. 6 mills   *f.* 7 mills   *g.* 8 mills   *h.* 9 mills

Multiplying a Decimal by 10, 100, etc.

Preparatory Exercises

1. Multiply by 10: *a.* 3 tenths. *b.* 5 hundredths. *c.* 23 thousandths. *d.* 1 and 5 tenths.

2. Multiply by 100: *a.* .32. *b.* 3.65. *c.* 42.7. *d.* .003. *e.* 1.234. *f.* 3.5.

3. Multiply by 1000: *a.* 2.7. *b.* 4.03. *c.* .502. *d.* .007. *e.* 1.234. *f.* 3.7.

To multiply a decimal by 10, 100, 1000, *etc., move the decimal point one, two, three, etc., places to the right, annexing ciphers when necessary.*

Sight Exercises

1. Give products:

a. 10 × 8.46	*b.* 13.07 × 10	*c.* .05 × 1000
d. 100 × 9.5	*e.* 24.6 × 100	*f.* 1000 × .22
g. 10 × 6.09	*h.* 10 × 23.75	*i.* 100 × 4.09

2. Multiply:

a. 30 × .12	*b.* 22.06 × 40	*c.* 20 × 6.034
d. 20 × 4.5	*e.* 1.2 × 500	*f.* 300 × .421
g. 200 × 3.21	*h.* .232 × 30	*i.* 50 × 1.02

Written Exercises

1. At $800 per mile, find the cost of building a road 7.845 miles long.

2. Multiply:

a. 80 × 3.745	*b.* 4.076 × 700	*c.* 900 × 3.18
d. 50 × 463.4	*e.* .069 × 8000	*f.* 7000 × .49
g. 600 × .085	*h.* 23.819 × 60	*i.* 400 × 23.8

Dividing by 10, 100, 1000, etc.

Preparatory Exercises

1. Divide by 10 : *a.* 3.　*b.* 7 tenths.　*c.* 17 hundredths.　*d.* 1 and 5 tenths.

2. Divide by 100 : *a.* 23.　*b.* 2.3.　*c.* 3 tenths.　*d.* 2 and 8 tenths.

3. Divide by 1000 : *a.* 37.　*b.* 3.　*c.* 149.　*d.* 1875. *e.* 21437.

To divide a decimal by 10, 100, *etc., move the decimal point one, two, etc., places to the left, prefixing decimal ciphers when necessary.*

Sight Exercises

1. Give quotients :

a. 846 ÷ 10	*b.* 957 ÷ 100	*c.* 8 ÷ 1000
d. 73.9 ÷ 10	*e.* 83.5 ÷ 100	*f.* 16 ÷ 1000
g. 6.45 ÷ 10	*h.* 6.3 ÷ 100	*i.* 253 ÷ 1000

Divisors ending in Ciphers

1. A piece of ground contains 204.8 square rods. At 160 square rods to the acre, find its area in acres.

Ans. 1.28 (A.)

$16\cancel{0})\overline{20.4/8}$
$\underline{16}$
$\ \ 44$
$\ \ \underline{32}$
$\ 128$
$\ \underline{128}$

PROCESS

Divide the divisor by 10 by canceling the terminal cipher. Divide the dividend by 10 by moving the decimal point one place to the left.

Divide 20.48 (the new dividend) by 16 (the new divisor).

Written Exercises

2. Find quotients:

a. 483 ÷ 40	*b.* 984 ÷ 60	*c.* 483 ÷ 300
d. 690 ÷ 80	*e.* 72.1 ÷ 50	*f.* 248 ÷ 500
g. 51.7 ÷ 20	*h.* 576 ÷ 90	*i.* 11.9 ÷ 700

Decimal Divisors

1. At 16.5 feet to the rod how many rods are there (*a*) in 79.596 feet? (*b*) In 20,361 feet?

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(*a*)   **PROCESS**   (*b*)

Ans.   4.824 (rods)   *Ans.*   1234 (rods)

16/5)79/5.96   16/5)20361/0
  660   165
 ————   ————
 1359   386
 1320   330
 ————   ————
  396   561
  330   495
 ————   ————
  660   660
  660   660
 ————   ————

Change 16.5 (the divisor) to the whole number 165 by moving the decimal point one place to the right, which multiplies it by 10. Multiply each of the two dividends by 10, in (*a*) by moving the decimal point one place to the right, and in (*b*) by annexing a cipher.

</div>

2. Find quotients:

a. 2.08 ÷ 3.2   *b.* 76.8 ÷ .24   *c.* 1.368 ÷ .9   *d.* 6.5 ÷ .125

3. Divide:

a. 12.124 ÷ 3.5   *b.* 8.4 ÷ .032   *c.* .252 ÷ .48   *d.* 209 ÷ 1.6

Sight Problems

1. What is the cost of silk per yard, when 8 yards cost $9 ?

2. At 5 mills each, what is the cost of 144 pens ?

3. After walking 11.9 miles, how far must a boy walk to complete 20 miles ?

4. How many inches are there in 1000 meters, a meter being 39.37 inches ?

5. A surveyor's chain consists of 100 links of 7.92 inches each. How many inches long is the chain ?

6. Change 10 ounces to the decimal of a pound.

7. How many inches are there in .75 yard ?

8. Find the cost of 4125 bricks at $8 per 1000.

9. The difference in the size of two fields is 1.5 acres ; the smaller contains 8.35 acres ; how many acres does the other contain ?

10. After spending 75 hundredths of his money a boy has 21 cents ; how much did he spend ?

11. How many inches are there in 3.25 feet ?

12. The owner of $\frac{5}{8}$ of a vessel sold .6 of the vessel ; what decimal of the vessel did he then own ?

13. How much must be added to $\frac{13}{25}$ of a dollar to make 8 dimes ?

14. Reduce .25 of a yard to the decimal of a foot.

15. Change 3 hours to the decimal of a day.

16. (*a*) What fraction of a bushel is 12 qt. ? (*b*) What decimal ?

17. How many mills in .25 dollar ?

18. What is the value of a German 20-mark piece in United States money at 23.8 cents to the mark ?

Written Problems

1. What is the cost of cloth per yard when 164 yards cost $184.50?

2. At 4 mills on the dollar how much taxes must be paid on property valued at $12,450?

3. After traveling 34.875 miles, how far must a man go to travel 40 miles?

4. What is the cost in United States money of an automobile valued at 8000 francs, at 19.3 cents each?

5. A surveyor's chain consists of 100 links of 7.92 inches each. What is its length (*a*) in feet? (*b*) In rods?

6. Change 22.5 minutes to the decimal of an hour.

7. How many cubic feet are there in 9.375 cords at 128 cubic feet to the cord?

8. Find the cost of 78,625 feet of lumber at $16 per 1000 feet.

9. The difference in the size of two fields is 10.375 acres; the smaller contains 24.65 acres. How many acres does the other contain?

10. After selling 875 thousandths of his hay, a man has 112 tons left. How many tons had he at first?

11. How many minutes are there in 55 hundredths of an hour?

12. The owner of .75 of a schooner sold .8 of his share. (*a*) What decimal of the boat did he sell? (*b*) At the rate of $1500 for the share sold, what is the value of the schooner?

13. How much less than $500 are 100 pounds sterling, which are equal to $486.65?

Multiplying and Dividing by .125

Sight Exercises

1. At 320 rods to the mile, how many rods are there in
.125 mile ?

PROCESS

320 rd. × .125 = 320 rd. × $\frac{1}{8}$ = 320 rd. ÷ 8 = 40 rd. *Ans.*

---

2. Find products :

a. 24 × .125   *b.* .125 × 32   *c.* 168 × .125   *d.* .125 × 488
e. 64 × .125   *f.* .125 × 96   *g.* 248 × .125   *h.* .125 × 648

3. Into how many building sites each containing .125
acre can a field containing 31 acres be divided ?

Written Exercises

1. How many cubic feet are there in 9.125 cords of
wood at the rate of 128 cubic feet to the cord ?

PROCESS

128 cu. ft.	Even if 9.125 is indicated as the mul-
× 9.125	tiplier, use 9⅛. The former may be written
16	as is here shown, with the decimal extend-
1152	ing beyond the ones' figure of the mul-
Ans. 1168 cu. ft.	tiplicand.

---

2. Find products :

a. 256 × .125   *b.* 2.125 × 368   *c.* 496 × 3.125

3. How many pieces of ribbon each .125 yd. long can
be cut from a roll containing (*a*) 32 yd. ? (*b*) 31.75 yd. ?
(*c*) 32.625 yd. ?

PROCESS

(*a*) .125 yd.)32 yd.   (*a*) Indicate the division of
     Ans. 256 (pieces)   32 by .125, but obtain the result
                        by multiplying the former by 8.

(*b*) .125 yd.)31.75 yd.   (*b*) In writing the product
     Ans. 254 (pieces)   of 31.75 by 8, omit the decimal
                        ciphers.

                        (*c*) If you remember that
(*c*) .125 yd.)32.625 yd. .625 = ⅝, think at once .625 × 8
     Ans. 261 (pieces)   = 5, and carry 5 to the product
                        of 8 times 2.

---

4. Find quotients:

a. 28 ÷ .125   *b.* 28.125 ÷ .125   *c.* 28.5 ÷ .125
d. 34 ÷ .125   *e.* 34.375 ÷ .125   *f.* 36.4 ÷ .125

Denominate Numbers

Liquid Measure   **Dry Measure**

2 pints (pt.) 1 quart (qt.)   8 quarts (qt.) 1 peck (pk.)
4 quarts   1 gallon (gal.) 4 pecks   1 bushel (bu.)

Preparatory Exercises

1. (*a*) How many quarts of milk does a 10-gallon can contain? (*b*) How many pints?

2. What is the cost of 2 qt. 1 pt. of ice cream at the rate of 15 cents a pint?

3. How much does a farmer receive for a 40-quart can of milk at 13 cents a gallon?

4. How many ½-pint plates of ice cream are there in a gallon?

Reductions — Lower Denominations

Sight Exercises

1. Reduce :

a. 12 ft. to inches   *b.* 7 ft. 6 in. to inches
c. 4 yd. to inches   *d.* 41 yd. to feet
e. 9 yd. 2 ft. to feet   *f.* 2 rd. to feet

2. Change :

a. ¾ ft. to inches   *b.* .2 T. to pounds
c. .75 lb. to ounces   *d.* ⅔ yd. to feet
e. .5 ft. to inches   *f.* .25 yd. to inches

Written Exercises

1. When 1 inch of wire is required to make a tack, how many tacks can be made (*a*) from 43 yards of wire ? (*b*) From 129 ft. 9 in. ?

PROCESS

(*a*) 43 (yd.)
  × 3 ft.
  129 (ft.)
   12 in.
 1548 in. *Ans.*

(*a*) Since there are 3 ft. in 1 yd., in 43 yd. there are 43 times 3 ft., or 129 ft. Since there are 12 inches in 1 ft., in 129 ft. there are 129 times 12 in., or 1548 in. In practice, however, use 3 and 12 as the multipliers.

(*b*) 129 ft. 9 in.
     12
 1557 in. *Ans.*

(*b*) Multiply 129 by 12 and "add in" 9. Think 12 nines are 108; adding in 9, makes 117; write 7 and carry 11. Think 12 twos are 24; carrying 11, makes 35; write 5 and carry 3; etc.

---

2. Reduce :

a. 47 yd. to inches   *b.* 27. ft. 6 in. to inches
c. 28 bu. to quarts   *d.* 22 pk. 6 qt. to quarts
e. 83 gal. to pints   *f.* 39 qt. 1 pt. to pints

Higher Denominations

Sight Exercises

1. Reduce:

a. 120 in. to ft.   *b.* 129 in. to ft. and in.

c. 160 qt. to gal.   *d.* 161 qt. to gal. and qt.

2. Change to a fraction of the next higher denomination:

a. 40 sec.   *b.* 1 pt.   *c.* 2 qt.   *d.* 8 in.   *e.* 2 ft.

3. Change to a decimal of the next higher denomination:

a. 45 min.   *b.* 12 sec.   *c.* 3 mo.   *d.* 10 oz.   *e.* 3 pk.

Written Exercises

1. When 1 inch of wire is required to make a tack, how much wire will be required to make (*a*) 900 tacks? (*b*) 1000 tacks?

PROCESS

(*a*)   12)900 (in.)   (*b*)   12)1000 (in.)

       3)75 (ft.)   3)83 (ft.) 4 in.

         25 (yd.) *Ans.*   *Ans.* 27 yd. 2 ft. 4 in.

(*a*) Divide 900 in. by 12 in.; this gives 75 as the number of feet. Divide 75 by 3 to get the number of yards.

(*b*) Divide 1000 in. by 12 in.; this gives 83 as the number of feet, with 4 inches remaining. Divide 83 feet by 3 feet; this gives 27 as the number of yards with 2 feet remaining.

---

2. Reduce to yards:

a. 648 in.   *b.* 996 in.   *c.* 864 in.   *d.* 756 in.

3. Reduce to yards and feet:

a. 397 ft.   *b.* 865 ft.   *c.* 578 ft.   *d.* 899 ft.

4. Reduce to feet and inches:

a. 150 in.   *b.* 400 in.   *c.* 625 in.   *d.* 795 in.

Compound Numbers. Addition and Multiplication

A number containing two or more related denominate units is called a *compound* number.

Sight Exercises

1. Give sums in bu. and pk., gal. and qt., etc.

a. 3 pk. *b.* 1 bu. 3 pk. *c.* 1 gal. 3 qt. *d.* 1 gal. 3 qt.
 + 2 pk.   + 2 pk.   + 2 qt.   + 1 gal. 3 qt.

e. 9 oz. *f.* 1 lb. 9 oz. *g.* 1 yd. 2 ft. *h.* 2 yd. 2 ft.
 + 9 oz.   + 9 oz.   + 2 ft.   + 3 yd. 1 ft.

2. Give products:

a. 3 pk. *b.* 1 bu. 3 pk. *c.* 1 gal. 3 qt. *d.* 1 gal. 3 qt.
 × 2   × 3   × 2   × 4

e. 9 oz. *f.* 1 lb. 9 oz. *g.* 2 lb. 6 oz. *h.* 1 pk. 7 qt.
 × 2   × 2   × 3   × 2

Written Exercises

1. A dealer sold 10 gal. 2 qt. of gasoline to one customer, 12 gal. 1 qt. to another, and 13 gal. 3 qt. to a third. How much did he sell the three customers?

2. Add the following:

a. 17 bu. 3 pk. + 13 bu. 2 pk. + 6 bu. 1 pk.

b. 18 gal. 2 qt. + 13 gal. 2 qt. + 4 gal. 2 qt.

3. If an automobile uses 3 gal. 3 qt. of gasoline per day, how much will it use in 6 da. ?

4. Multiply :

a. 17 bu. 3 pk. by 5   *b.* 18 gal. 2 qt. by 7
        c. 14 pk. 7 qt. by 2

Subtracting Compound Numbers

Sight Exercises

1. Give remainders :

a. 1 pk.	*b.* 2 pk. 1 qt.	*c.* 1 bu. 1 pk.	*d.* 3 gal. 2 qt.
— 5 qt.	— 5 qt.	— 3 pk.	— 3 qt.

e. 2 pk. 1 qt.	*f.* 3 bu. 2 pk.	*g.* 4 gal. 2 qt.	*h.* 4 ft. 6 in.
—1 pk. 5 qt.	—1 bu. 3 pk.	— 2 gal. 3 qt.	— 2 ft. 8 in.

Written Exercises

1. From a barrel of oil containing 45 gal., 28 gal. 2 qt. are sold. How many gallons remain?

2. Subtract:

a. 84 bu.	*b.* 68 gal. 1 qt.	*c.* 32 pk. 4 qt.
— 35 bu. 3 pk.	— 39 gal. 3 qt.	— 18 pk. 6 qt.

d. 48 qt.	*e.* 45 lb. 7 oz.	*f.* 72 yd.
— 29 qt. 1 pt.	— 26 lb. 9 oz.	— 25 yd. 1 ft.

Dividing Compound Numbers

Written Exercises

1. An automobile uses 19 gal. 2 qt. of gasoline in 6 da. How many gallons and quarts does it use, on an average, per day?

2. Divide:

a. 23 lb. 2 oz. ÷ 5	*b.* 16 pk. 4 qt. ÷ 6	*c.* 69 lb. ÷ 8
d. 33 bu. 1 pk. ÷ 7	*e.* 31 gal. 2 qt. ÷ 9	*f.* 80 yd. ÷ 3

3. When a machine uses gasoline at the rate of 3 gal. 2 qt. per day, how long will 84 gal. last?

Measurements — Areas of Rectangles

Preparatory Exercises

1. (*a*) How many inches are there in each side of a 1-foot square? (*b*) How many square inches are there in a square 12 inches long and 12 inches wide? (*c*) How many square inches are there in a square foot?

2. (*a*) How many feet are there in each side of a 1-yard square? (*b*) How many square feet are there in a square 3 feet long, 3 feet wide? (*c*) How many square feet are there in a square yard?

3. (*a*) How many square yards are there in a square 5½ yards long, 5½ yards wide? (*b*) How many square yards are there in a square rod?

Square Measure

144 square inches (sq. in.)	1 square foot (sq. ft.)
9 square feet	1 square yard (sq. yd.)
30¼ square yards	1 square rod (sq. rd.)
160 square rods	1 acre (A.)
640 acres	1 square mile (sq. mi.)

Sight Problems

1. A field is 40 rods long, 40 rods wide. (*a*) How many square rods does it contain? (*b*) How many acres?

2. What are the dimensions of a square field containing 1600 square rods?

3. (*a*) What fraction of a square mile is there in a field ½ mile square? (*b*) How many acres?

4. It takes a mile of wire fencing to enclose a square field. (*a*) What fraction of a square mile does the field contain? (*b*) How many acres?

Written Problems

1. How many acres are there in a field 60 rods wide, 120 rods long ?

PROCESS

$$\frac{60 \times 120}{160} = ? \; A.$$

Indicate the number of *square rods* in the area by writing 60 × 120. Indicate the number of *acres* by writing 160 as the divisor of the foregoing. Cancel.

---

2. How many acres are there in a city block (*a*) 16 rods wide and 40 rods long ? (*b*) $\frac{1}{20}$ mile wide and $\frac{1}{8}$ mile long ? (*c*) $\frac{1}{20}$ mile wide and $\frac{1}{8}$ mile long ?
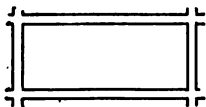
3. (*a*) How many feet wide is a block, including its share of the street, when there are 20 blocks to a mile ? How long is a block when (*b*) there are 8 blocks to a mile ? (*c*) 6 blocks to a mile ? (*d*) 10 blocks to a mile ?

4. At $2 per square yard, find the cost of a concrete sidewalk 9 ft. wide, 20 ft. long.

Preparatory Exercises

1. The top layer of a box of caramels has 4 rows of 3 caramels each. (*a*) How many caramels are there in the top layer ? (*b*) In the bottom layer ? (*c*) How many caramels does the box contain if there are two layers ?

2. How many 1-inch cubes could be placed in a box 6 inches long, 5 inches wide, 4 inches deep, inside measurement ?

3. What is the capacity of a box 4 ft. long, 3 ft. wide, 2 ft. deep ?

Volumes of Rectangular Solids

The term *solid*, in connection with measurements, is applied as well to an empty box as to a brick; and the term *volume* is used to denote the *capacity* of the former and also the *cubic contents* of the latter.

A *rectangular solid* has six faces, each of which is a rectangle.

Sight Problems

1. How many cubic inches are there in a brick (*a*) 8 inches long, 4 inches wide, $2\frac{1}{2}$ inches thick? (*b*) 8 inches long, 4 inches wide, 2 inches thick?

2. What fraction of a cubic foot is there in a brick $\frac{2}{3}$ ft. long, $\frac{1}{3}$ ft. wide, $\frac{1}{6}$ ft. thick?

3. (*a*) How many cubic feet are there in a 3-foot cube? (*b*) How many cubic yards? (*c*) How many cubic feet are there in a cubic yard?

Written Exercises

1. How many cubic inches are there in a 12-inch cube?

2. At 231 cubic inches to the gallon, how many cubic inches are there in $7\frac{1}{2}$ gallons?

3. At $1\frac{1}{4}$ cubic feet to the bushel, (*a*) what fraction of a bushel is 1 cubic foot? (*b*) What decimal?

4. How many cubic inches are there in $1\frac{1}{4}$ cubic feet?

5. A cubic foot of water weighs $62\frac{1}{2}$ pounds. Find the weight of a gallon of water, taking $7\frac{1}{2}$ gallons to the cubic foot.

6. How many ounces does a cubic foot of water weigh?

Surfaces of Rectangular Solids

Sight Problems

1. How many square yards are there (*a*) in the floor of a room 6 yards long, 5 yards wide ? (*b*) In the ceiling of a room 18 feet long, 15 feet wide ? If the room is 9 feet high, (*c*) how many square yards are there in each of the two larger walls ? (*d*) In each of the two smaller walls ?

2. The top of a brick measures 8 inches by 4 inches. (*a*) What fraction of a square foot would the bottom of a brick cover ? (*b*) How many would be required to cover a square foot ? One side of a brick measures 4 inches by 2 inches. (*c*) What fraction of a square foot would the side of a brick cover ? (*d*) How many bricks laid on the side would cover a square foot ?

3. How many square feet of sheet iron are there in the sides and the bottom of a tank 6 feet long, 5 feet wide, and 4 feet deep, allowing 1 square foot for overlapping at the joints ?

Sight Exercises

1. Give in square inches the areas of rectangles having dimensions as follows :

a. 36 in. by 25 in.   *b.* 3 ft. by 2 ft. 1 in.   *c.* 1 yd. by 25 in.
d. 25 in. by 44 in.   *e.* 2 ft. by 4 ft. 2 in.   *f.* 1 yd. by 10 in.

2. Give areas in square feet :

a. 25 ft. by 16 ft.   *b.* 8 ft. by 6 ft. 6 in.   *c.* 9 yd. by 16 in.
d. 88 ft. by 50 ft.   *e.* 9 ft. by 4 ft. 4 in.   *f.* 8 yd. by 18 in.

3. Give areas in square yards :

a. 36 yd. by 25 yd.   *b.* 6 yd. by 1 ft. 6 in.   *c.* 4 yd. by 18 in.
d. 36 ft. by 20 yd.   *e.* 4 yd. by 2 ft. 3 in.   *f.* 8 yd. by 27 in.

Sight Problems

1. A bin is 5 ft. long, 5 ft. wide, and 5 ft. high. (*a*) How many cubic feet of grain will it hold? (*b*) How many bushels of grain will it hold at 1.25 cubic feet to the bushel?

2. At the rate of 16 bushels of wheat to the acre, how many acres will yield 100 bushels of wheat?

3. A train goes 720 miles in 18 hours. What is its average rate per hour?

4. A man sold a farm at 1.25 times the price he paid for it. If he sold it for $12,500, what did he pay for it?

5. A boy raised 88 bushels of corn on .8 acre. What is the yield to the acre at that rate?

6. At 80 bushels to the acre what would be the yield on 1.2 acres?

7. Assuming that a pint of water weighs a pound, what would be the weight of $7\frac{1}{2}$ gallons of water?

8. What is the weight of a gallon of milk when 8 gallons weigh 69 pounds?

9. When it takes 25 pounds of milk to make 1 pound of butter, (*a*) what decimal of a pound of butter does a pound of milk make? (*b*) At 30 cents per pound for the butter, what is the value of the butter made from a pound of milk?

10. A train travels 360 miles from 9 A.M. to 7 P.M. What is its average rate per hour?

11. How many square inches are there in a moving picture film 12,000 inches long, $1\frac{1}{4}$ inches wide?

12. A man worked 300 days in a year at the rate of $3 a day. If his expenses averaged $50 per month, what were his yearly savings?

Written Problems

1. A bin is 6.25 ft. long, 3.2 ft. wide, and 4.5 ft. high. (*a*) How many cubic feet of grain will it hold ? (*b*) How many bushels will it hold at the rate of 1.25 cubic feet to the bushel ?

2. At the rate of 62.5 bushels of corn to the acre, how many acres will be required to yield 1000 bushels of corn?

3. A train goes 851 miles in 18.4 hours. What is its average rate per hour ?

4. A man sold a farm at 1.25 times the price he paid for it. If he received $3000 for the farm, what did it cost him ?

5. A boy raised 90 bushels of corn on .72 acre. What could he have raised on an acre at this rate ?

6. At 84 bushels of corn to the acre, what would be the yield of 87.5 acres ?

7. Milk is how many times as heavy as water when the former weighs 8⅝ lb. per gal. and the latter 8⅜ lb. ? Give answer as a mixed decimal.

8. When milk weighs 8.625 pounds per gallon, how many gallons of milk are there in 690 pounds ?

9. If it takes 25 pounds of milk to make 1 pound of butter, (*a*) what decimal of a pound of butter is made from 8.625 pounds of milk ? (*b*) What is the butter worth at 30 cents per pound ?

10. How many square feet are there in a moving-picture film 1500 feet long, 1¼ inches wide ?

11. A man worked 300 days in a year, for which he received on an average $3.50 per day. His expenses averaged $2.50 per day for 365 days. How much could he save in a year ?

Reviews — Addition and Subtraction

Oral Drills

To increase a number by 19, 39, 99, etc., increase it by 20, 40, 100, etc., and from the sum subtract 1. Why?

To add 157 and 29, think 187 (157 + 30), 186 (subtracting 1).

1. Give sums:

a. 166 + 19	*b.* 567 + 29	*c.* 215 + 499	*d.* 618 + 299
e. 223 + 59	*f.* 634 + 49	*g.* 374 + 199	*h.* 225 + 699
i. 368 + 39	*j.* 716 + 79	*k.* 183 + 599	*l.* 130 + 899
m. 425 + 69	*n.* 892 + 89	*o.* 437 + 399	*p.* 154 + 799

To subtract 29 from 157, think 127 (157 − 30), 128 (adding 1).

2. Give remainders:

a. 166 − 19	*b.* 567 − 29	*c.* 615 − 499	*d.* 618 − 399
e. 283 − 59	*f.* 634 − 49	*g.* 374 − 199	*h.* 925 − 699
i. 368 − 39	*j.* 716 − 79	*k.* 883 − 599	*l.* 830 − 799
m. 495 − 69	*n.* 823 − 89	*o.* 437 − 299	*p.* 422 − 199

Sight Problems

1. One field yielded 528 bushels of wheat and another yielded 399 bushels. (*a*) What was the yield of the two fields? (*b*) How many more bushels did one yield than the other?

2. In 1915 Jamesville had 899 inhabitants; in 1916 it had 975. What was the increase for the year?

3. A girl bought a hat for $8.25 and dry goods to the amount of 69 cents. How much did she spend for both?

4. William has read 199 pages of a book containing 317 pages. How many pages has he still to read?

Written Exercises

1. From the following table find (*a*) the total number of bushels of each kind of grain received during the week ; (*b*) the whole number of bushels of grain received each day in the week ; and (*c*) the whole number of bushels of grain received.

DAYS	BUSHELS					TOTALS
	Wheat	Rye	Corn	Oats	Barley	
Monday	2,617	1,484	4,865	6,876	983	16,825
Tuesday	3,208	1,676	3,723	5,943	1,025	(*b*)
Wednesday . . .	1,579	1,520	5,179	5,150	868	(*b*)
Thursday	2,987	1,799	2,344	6,382	1,129	(*b*)
Friday	3,166	2,047	4,777	4,464	748	(*b*)
Saturday	998	1,613	2,983	5,876	1,234	(*b*) ·
Totals . . .	14,555	(*a*)	(*a*)	(*a*)	(*a*)	(*c*)

Verify the correctness of the work by comparing the sum of the totals of the last line with the sum of the totals of the last column.

2. A farmer sold 6 loads of hay at 50 cents per 100 pounds. Fill out the missing items in the following statement :

GROSS WEIGHT	WEIGHT OF WAGON	NET WEIGHT	VALUE AT 50 ¢ PER 100 LB.
3,576 lb.	1,328 lb.	2,248 lb.	$11.24
3,424	1,284		
3,562	1,356		
3,517	1,381		
3,449	1,273		
3,463	1,209		
Totals (*a*) lb.	(*b*) lb.	(*c*) lb.	$ (*d*)

3. The following table shows the attendance of each of the eight grades in the Hillside School for each school day of a week :

DAYS	GRADES								SCHOOL
	1st	2d	8d	4th	5th	6th	7th	8th	
Monday	42	39	36	34	29	25	21	19	245
Tuesday	43	38	37	33	28	24	22	19	(b)
Wednesday . . .	42	39	36	34	26	26	20	19	(b)
Thursday	44	40	39	35	29	26	22	19	(b)
Friday	44	39	37	34	28	24	20	19	(b)
Weekly aggregate .	215	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(c)
Daily average . .	43	(d)	(d)	(d)	(d)	(d)	(d)	(d)	(e)

Find (a) the weekly aggregate attendance of each grade; (b) the attendance of the school for each day; (c) the aggregate attendance of the school for the week; (d) the average daily attendance by grades; and (e) the average daily attendance of the school.

4. On March 1, a man bought goods amounting to $100. During the month he made payments as follows: $27.48, $8.94, $13.27, and $29.88. Find the balance due March 31. (See page 97.)

$100.
27.48
8.94
13.27
29.88
$??.43

5. From 2345 take the sum of 456, 789, 28, 142, 356, and 25.

6. Deduct the sum of $13.29, $8.86, $4.57, and $9.50 from $50.

7. A woman deposited $85.50 in the bank. She took out at different times $4.75, $23.90, $8.64, and $17.77. How much had she remaining in the bank?

Multiplication. Short Methods

Sight Drills

Announce the product of 30 × 43 as twelve ninety; that
of 25 × 88 as 22 hundred.

1. Give products:

a. 33	*b.* 62	*c.* 81	*d.* 51	*e.* 71	*f.* 84
× 30	× 40	× 50	× 70	× 80	× 20

g. 91	*h.* 44	*i.* 84	*j.* 48	*k.* 24	*l.* 36
× 60	× 25	× 25	× 25	× 25	× 25

Written Exercises

1. If a cow gives on an average 147 pounds of milk
per week, how many pounds will she give (*a*) in 42 weeks?
(*b*) In 24 weeks?

PROCESS

(*a*) 147 lb.   In (*a*) multiply 294 by 2 to (*b*) 147 lb.

    42   get the product of 147 by 4.   24

  294   In (*b*) multiply first by 2   294

  588   (tens) placing the right-hand   588

Ans. 6174 lb.   figure of the product under 2.   3528 lb.
             Multiply this product by 2 to

get the product of 147 by 4.   Place the right-hand figure of the
second product under the 4 in the multiplier.

---

2. Find products :

a. 325 × 42	*b.* 165 × 24	*c.* 235 × 93	*d.* 365 × 39
e. 234 × 62	*f.* 345 × 26	*g.* 456 × 63	*h.* 567 × 36

3. An engine pumps (*a*) 631 tons of water per day.
How many tons does it pump in a year? (*b*) How many
tons are pumped in a year by an engine that pumps 136
tons per day ?

PROCESS

(a) 365×631 T.   To   avoid   (b) 365×136 T.
        1095   writing an un-   1095
        2190   necessary line,   2190
                              use 365 for the
Ans. $\overline{230315}$ T.   first   partial   *Ans.* $\overline{49640}$ T.
product.   To get the product by 6, take twice the· product by 3.

4. Find products :

a. 523×421 *b.* 632×124 *c.* 234×631 *d.* 342×136

Multiplying by $33\frac{1}{3}$; by $16\frac{2}{3}$

Preparatory Exercises

1. *a.* What is $\frac{1}{3}$ of 100?   *b.* $33\frac{1}{3}$ is what part of 100?

2. *a.* $33\frac{1}{3} = 100 \times$?   *b.* $16\frac{2}{3} = 100 \times$?

3. *a.* $33\frac{1}{3} \div 100 =$?   *b.* $16\frac{2}{3} \div 100 =$?

Sight Problems

1. How far will a train go in 24 hours at the rate of
(a) $33\frac{1}{3}$ miles per hour?   (b) $16\frac{2}{3}$ miles per hour?

PROCESS

(a) $24 \times 33\frac{1}{3} = 2400 \div 3 = 800$ (mi.)   *Ans.*
(b) $24 \times 16\frac{2}{3} = 2400 \div 6 = 400$ (mi.)   *Ans.*

2. At $33\frac{1}{3}$ cents per pair what will be the cost of 3
dozen pairs of stockings ?

3. Find the area of a rectangle 123 yards long, $33\frac{1}{3}$
yards wide.

Multiplying by 125

Sight Exercises

1. A building lot is 125 feet deep. How many square feet does it contain when its width is (*a*) 24 feet? (*b*) 25 feet?

PROCESS

(*a*) 24 × 125 = 24 thousand ÷ 8 = 3 thousand.   *Ans.* 3000 ft.
(*b*) 25 × 125 = 25 thousand ÷ 8 = 3⅛ thousand.   *Ans.* 3125 sq. ft.

---

2. Give products : *a*. 48 × 125.   *b*. 125 × 49.   *c*. 56 × 125.   *d*. 125 × 68.

3. How many square yards are there in a piece of ground 68 yards long and (*a*) 16⅔ yards wide?   (*b*) 33⅓ yd. wide?

PROCESS

(*a*) 68 × 16⅔ = 68 hundred ÷ 6 = 11⅓ hundred = 1133⅓ (sq. yd.)
(*b*) 68 × 33⅓ = 68 hundred ÷ 3 = 22⅔ hundred = 2266⅔ (sq. yd.)

---

4. Multiply 25 (*a*) by 25.   (*b*) By 16⅔.   (*c*) By 33⅓. (*d*) By 12½.   (*e*) By 125.

Written Exercises

1. Find the cost of 217 building plots at $125 each.

PROCESS

$125
× 217
Ans. $27125

Use 125 as the multiplier. Divide 217 (thousand) by 8, which gives 27⅛ (thousand) for quotient. Affix 125 to 27.

Always refrain from employing unnecessary figures. Arrange the example in some such form as the above. Do not affix ciphers to 217.

2. Find products :

a. 125×231 *b.* 432×125 *c.* 125×521 *d.* 618×125

3. Multiply :

a. 279	*b.* 322	*c.* 487	*d.* 542	*e.* 653
$\times 33\frac{1}{3}$	$\times 33\frac{1}{3}$	$\times 16\frac{2}{3}$	$\times 16\frac{2}{3}$	$\times 16\frac{2}{3}$

Written Problems

1. How many square feet are there in a building plot 225 feet long, 125 feet wide ?

2. When the average yield of wheat is 12.5 bushels to the acre, what profit is made on 40 acres if it is sold for 96 cents per bushel and the cost of producing it is $\$8.12\frac{1}{2}$ per acre ?

3. How many hours are spent in a year in washing dishes if 30 minutes are spent three times a day ?

4. What is the profit on 32 acres of potatoes averaging 125 bushels to the acre when they are sold at 75 cents per bushel and the cost of raising them is $\$30$ per acre ?

5. At 3200 hills to the acre, how many bushels of corn will be raised on an acre when each hill yields 4 ears and 125 ears make a bushel ?

Dividing by $16\frac{2}{3}$, $33\frac{1}{3}$, 125

Sight Exercises

1. (*a*) At $16\frac{2}{3}$ miles per hour, how long would it take an automobile to go 1200 miles ? (*b*) At the rate of $33\frac{1}{3}$ bushels to the acre, how many acres would yield 3200 bushels ?

PROCESS

(*a*) $1200 \div 16\frac{2}{3} = 12 \div \frac{1}{6} = 12 \times 6 = 72.$ *Ans.* 72 hr.

(*b*) $3200 \div 33\frac{1}{3} = 32 \div \frac{1}{3} = 32 \times 3 = 96.$ *Ans.* 96 A.

---

2. Give quotients:

a. $16\frac{2}{3}$)300   *b.* $33\frac{1}{3}$)900   *c.* $16\frac{2}{3}$)800

3. Divide 350 (*a*) by $16\frac{2}{3}$.   (*b*) By $33\frac{1}{3}$.

PROCESS

(*a*) $350 \div 16\frac{2}{3} = 3\frac{1}{2} \div \frac{1}{6} = 3\frac{1}{2} \times 6 = 21.$ *Ans.*

(*b*) $350 \div 33\frac{1}{3} = 3\frac{1}{2} \div \frac{1}{3} = 3\frac{1}{2} \times 3 = 10\frac{1}{2}.$ *Ans.*

---

4. Divide:

a. $16\frac{2}{3}$)$316\frac{2}{3}$ *b.* $16\frac{2}{3}$)$233\frac{1}{3}$ *c.* $16\frac{2}{3}$)550

d. $16\frac{2}{3}$)$433\frac{1}{3}$ *e.* $16\frac{2}{3}$)$283\frac{1}{3}$ *f.* $16\frac{2}{3}$)450

5. At $125 each, how many building lots can be bought (*a*) for $2125?   (*b*) For $3250?   (*c*) For $4375? (*d*) For $5500?   (*e*) For $6625?

PROCESS

(*a*) $2125 \div 125 = 2\frac{1}{8} \div \frac{1}{8} = 2\frac{1}{8} \times 8 = 17.$ *Ans.* 17 lots.

(*b*) $3250 \div 125 = 3\frac{1}{4} \div \frac{1}{8} = 3\frac{1}{4} \times 8 = 26.$ *Ans.* 26 lots.

(*c*) $4375 \div 125 = 4\frac{3}{8} \div \frac{1}{8} = 4\frac{3}{8} \times 8 = 35.$ *Ans.* 35 lots.

(*d*) $5500 \div 125 = 5\frac{1}{2} \div \frac{1}{8} = 5\frac{1}{2} \times 8 = 44.$ *Ans.* 44 lots.

(*e*) $6625 \div 125 = 6\frac{5}{8} \div \frac{1}{8} = 6\frac{5}{8} \times 8 = 53.$ *Ans.* 53 lots.

---

6. Divide by 125:

a. 1125	*b.* 3125	*c.* 5125	*d.* 7125	*e.* 9125
f. 2250	*g.* 4250	*h.* 3375	*i.* 1375	*j.* 5375
k. 3500	*l.* 1500	*m.* 2625	*n.* 4625	*o.* 1625
p. 1750	*q.* 2750	*r.* 3875	*s.* 5875	*t.* 7875

Remainders in Division — Lowest Terms

Written Exercises

1. What is the average yield per acre when 475 tons of hay are raised on 175 acres?

NOTE. — In a problem of this kind, express a fraction in the answer in lowest terms.

2. Divide :

a. 1684 ÷ 32   *b.* 1050 ÷ 125   *c.* 24250 ÷ 375   *d.* 1545 ÷ 75
e. 2425 ÷ 80   *f.* 1092 ÷ 144   *g.* 30500 ÷ 625   *h.* 1920 ÷ 45

3. A farmer raised 481 tons on 185 acres. Find the average yield per acre.

PROCESS

$$2\tfrac{111}{185} \text{ T.} = 2\tfrac{3}{5} \text{ T.} \quad \textit{Ans.}$$

185)481 T.
  370
  ─────
  111

When it is difficult to obtain by inspection a number that will divide both terms of a fraction, find their greatest common divisor.

GREATEST COMMON DIVISOR

Divide 185 by 111. Divide 111 (the first divisor) by 74 (the first remainder). Divide 74 (the second divisor) by 37 (the second remainder). As 37 is an exact divisor of 74, it is the greatest common divisor of 111 and 185. Divide both terms

$$\frac{111 \div 37}{185 \div 37} = \frac{3}{5}$$

of $\tfrac{111}{185}$ by 37, which reduces it to lowest terms.

Test by multiplying 185 by 2⅗.

```
        1
 111)185
    111   1
   ─────
    74)111
       74   2
      ─────
      37)74
         74
        ────
```

---

4. Divide :

a. 1161 ÷ 172   *b.* 5795 ÷ 228   *c.* 24089 ÷ 104   *d.* 1537 ÷ 174
e. 8717 ÷ 115   *f.* 1295 ÷ 296   *g.* 69657 ÷ 155   *h.* 4141 ÷ 123

Multiplication and Division — Cancellation

Written Exercises

1. When 74 men require 87 days to lay a sidewalk, how many days would 111 men require?

	PROCESS
(a) $87 \text{ da.} \times 74$	Indicate the time required by 1 man, which is 74 times the time required by 74 men.
(b) $\dfrac{87 \text{ da.} \times 74}{111} =$	As 111 men will require $\frac{1}{111}$ of the time required by 1 man, indicate the division of (a) by 111, which gives the form shown in (b). Cancel. Find the result.

2. At the rate of $84 profit a month when 15 men are employed, what is the monthly profit when 35 men are employed?

	PROCESS
(a) $\dfrac{\$84}{15}$	Indicate the profit of 1 man by writing $84 divided by 15, as at (a). Indicate the profit of 35 men by writing 35 times (a) as shown at (b).
(b) $\dfrac{\$84 \times 35}{15}$	

Sight Exercises

Give the largest number that will cancel both numbers in each of the following sets:

a. 15 and 40   *b.* 25 and 60   *c.* 21 and 39   *d.* 27 and 63
e. 17 and 51   *f.* 48 and 86   *g.* 20 and 70   *h.* 24 and 36
i. 26 and 39   *j.* 28 and 52.   *k.* 48 and 54   *l.* 18 and 45

Sight Problems

1. If 3 men can do a piece of work in 21 days, how long will 7 men require to do the same work?

2. When 7 half-pounds of sugar cost 21 cents, what will be the cost of 13 half-pounds?

3. How many yards of cloth will be required for 16 coats if 5 coats require 15 yards?

4. A farmer has hay to last 12 cows for 6 weeks. How many cows must he sell to make the hay last 9 weeks?

5. If 12 men require 9 days to do a piece of work, how long will 4 men require to do the same work?

Written Problems

1. When an automobile goes 57 miles in 1 hour 16 minutes, (*a*) what fraction of a mile does it go in 1 minute? (*b*) How many minutes does it require to go a mile?

2. The bill for 56 tons of copper amounted to $812. What was the price per ton?

3. It takes 18 minutes to run a film 1000 feet long. (*a*) How many feet run per minute? (*b*) How many seconds does it require per foot? (*c*) When there are 16 pictures to a foot, how many pictures are seen per minute?

4. A farmer paid 5¢ per pound for cows averaging 800 lb. He fed them at a cost of $1 per head, and paid $1 per head to market them. What was his profit per cow if each gained 200 pounds in weight and sold for 6¢ per pound?

5. (*a*) What does the packer receive for a cow weighing alive 1000 pounds and sold at 12¢ per pound dressed weight, the latter being .52 of the live weight? (*b*) What is his profit on a cow for which he paid $60, provided he obtains $5.40 for the hide and other by-products?

Cancellation

Sight Exercises

Give answers :

a. $\dfrac{36 \times 11}{12}$ b. $\dfrac{84}{17 \times 21}$ c. $\dfrac{25 \times 13}{5}$ d. $\dfrac{69}{23 \times 41}$ e. $\dfrac{17 \times 16}{34}$

f. $\dfrac{15 \times 22}{30}$ g. $\dfrac{99}{33 \times 19}$ h. $\dfrac{48 \times 22}{24}$ i. $\dfrac{75}{25 \times 16}$ j. $\dfrac{12 \times 84}{21}$

k. $\dfrac{99 \times 13}{33}$ l. $\dfrac{48}{11 \times 24}$ m. $\dfrac{46 \times 32}{23}$ n. $\dfrac{86}{43 \times 43}$ o. $\dfrac{20 \times 22}{88}$

Written Exercises

1. Divide $13 \times 17 \times 9 \times 8 \times 14$ by $27 \times 4 \times 7 \times 51$.

PROCESS

$$\dfrac{13 \times \cancel{17} \times \cancel{9} \times \cancel{8} \times \cancel{14}}{\cancel{27} \times \cancel{4} \times \cancel{7} \times \cancel{51}} = \frac{52}{9} = 5\tfrac{7}{9}. \quad \textbf{\textit{Ans.}}$$

Write the dividend above the line and the divisor below. Cancel each factor common to the divisor and the dividend. Write the product of the remaining factors of the dividend over the remaining factors of the divisor. When the former product is larger than the latter, perform the indicated division.

2. Divide:

a. $25 \times 76 \times 84 \times 54$ by $70 \times 20 \times 19 \times 36$
b. $74 \times 32 \times 95 \times 16$ by $19 \times 40 \times 37 \times 64$
c. $36 \times 96 \times 51 \times 17$ by $51 \times 72 \times 68 \times 56$
d. $92 \times 70 \times 54 \times 17$ by $24 \times 45 \times 16 \times 34$
e. $10 \times 88 \times 72 \times 63$ by $44 \times 49 \times 45 \times 18$
f. $58 \times 93 \times 57 \times 45$ by $90 \times 38 \times 31 \times 87$
g. $86 \times 52 \times 30 \times 63$ by $65 \times 42 \times 35 \times 43$

Written Problems

Indicate operations and solve by cancellation. Place divisors below a horizontal line.

1. Find the length of a rectangular field 36 rods wide that will be equal in area to a field 54 rods wide 88 rods long.

$$\text{Length in rods} = (54 \times 88) \div 36.$$

2. How deep must be a bin 14 feet long and 12 feet wide to contain the same quantity of grain as a bin 16 feet wide, 18 feet long, and 7 feet deep?

$$(16 \times 18 \times 7) \div (14 \times 12).$$

3. How many bushels of wheat at 98¢ per bushel will pay for 3 pieces of silk 14 yards to the piece costing 63 cents per yard?

4. If 36 acres of land yield 555 bushels of oats, how many bushels will 48 acres yield at the same rate?

5. What should be the cost of 9 pieces of cloth each containing 24 yards, if 8 pieces of the same cloth 27 yards each cost $162?

$$\$162 \div (27 \times 8) \times 9 \times 24; \text{ that is, } (\$162 \times 9 \times 24) \div (27 \times 8).$$

6. When a train goes 45 miles per hour, it requires 24 hours to make a trip. How many hours would it take if the speed were 36 miles per hour?

7. Find the cost of 4768 lb. oats at 48¢ per bushel of 32 lb.

8. A farmer exchanged 240 bushels of wheat at 95 cents per bushel for potatoes at 50 cents per bushel. How many bushels of potatoes did he receive?

9. If 1600 bushels of wheat were sold for $1500, what would 700 bushels bring at the same rate?

Denominate Numbers

Counting

1 dozen (doz.) = 12.   1 gross = 12 doz.
1 great gross = 12 gross.   A score = 20.

Paper Measure

A ream of wrapping paper consists of 20 quires of 24 sheets each.

A ream of printing paper contains 500 sheets.

Sight Exercises

1. How many are three score and ten?

2. What fraction of a dozen is $\frac{1}{2}$ score?

3. How many pencils in $\frac{1}{4}$ gross?

4. When pencils sell for $6 per gross what is the cost of a dozen at that rate?

5. How much does a dealer receive for a gross of pencils sold at 5 cents each?

6. How many sheets of wrapping paper in a ream?

7. Change 6 sheets to the decimal of a quire.

Written Exercises

1. Change 7 lb. 12 ounces to ounces.

2. How many pounds and ounces in 260 ounces?

3. How many weeks will 63 gallons of gasoline last if $\frac{9}{16}$ pint is used each day?

4. How many tons of 2000 pounds each are there in 100 long tons of 2240 pounds each?

5. How many yards are there in 3600 meters of 39.37 inches each?   (Cancel.)

Rate per 100, 1000, ton, etc.

Written Exercises

1. Find the cost of 125,440 lb. coal at $6.72 per long ton of 2240 lb.

This example may be worked (*a*) by finding the number of tons and multiplying the cost per ton by this number. The result may also be obtained by finding the cost per pound and multiplying this by the number of pounds.

$$(a) \ \$6.72 \times \frac{125440}{2240} \qquad (b) \ \frac{\$6.72}{2240} \times 125440$$

A general method (*c*) is to indicate the operation by placing the multipliers above the line and the divisors below. $\qquad (c) \ \dfrac{\$6.72 \times 125440}{2240}$

In the following examples first indicate the operations. A divisor of 100 or 1000 should not always be canceled.

2. Find the cost of the following:

a. 37580 bricks at $7.50 per M (1000).

b. 44976 lb. hay at $87\frac{1}{2}$ ¢ per cwt. (100 lb.)

c. 71456 lb. oats at 48 ¢ per bushel of 32 lb.

d. 15280 lb. herrings at $1.25 per kit of 20 lb.

e. 28028 lb. flour at $5.75 per barrel of 196 lb.

f. 54250 shingles at $4.80 per M.

g. 63336 lb. corn at 63 ¢ per bushel of 56 lb.

h. 84375 ft. lumber at $5.60 per 1000 ft.

i. 91136 cu. ft. wood at $4.50 per cord (128 cu. ft.).

j. 12960 sheets of paper at $1.44 per ream (480 sheets).

k. 49464 lb. potatoes at 85 ¢ per bushel of 60 lb.

l. Interest on $487.50 at $6 per $100.

m. Taxes on $24375 at $8 per $1000.

n. 37482 pencils at $2.88 per gross (144).

o. 24056 eggs at 18 ¢ per dozen.

p. 86418 lb. wheat at 90 ¢ per bushel of 60 lb.

Rate per dozen, ton, 100, 1000, etc.

Sight Exercises

Find the cost of the following :

a. 375 bricks at $8.40 per 1000.

$$\text{¾ of } \$8.40.$$

b. 480 lb. hay at 87½ ¢ per hundredweight.

480 lb. at ⅞ ¢ per pound.

c. 640 lb. oats at 53 ¢ per bushel of 32 lb.

20 bu. at 53 ¢.

d. 240 lb. herrings at $1.25 per kit of 20 lb.

12 kits at $1¼.

e. 800 lb. pork at $12.10 per barrel of 200 lb.

f. 3000 shingles at $4.20 per M (1000).

g. 692 lb. corn at 56 ¢ per bushel of 56 lb.

h. 840 ft. lumber at $7.50 per 1000 ft.

¾ ¢ per foot.

i. 256 cu. ft. wood at $4.25 per cord (128 cu. ft.).

j. 888 sheets paper at $1.25 per ream (500 sheets).

k. 360 lb. potatoes at 80 ¢ per bushel of 60 lb.

l. Interest on $300 at $4 per $100.

m. Taxes on $11,000 at $8 per $1000.

n. 232 pencils at $2.88 per gross (144).

o. 162 eggs at 24 ¢ per dozen.

p. 180 lb. wheat at $1 per bushel of 60 lb.

q. 1200 lb. mackerel at $21 per barrel of 200 lb.

r. 312 qt. milk at 16 ¢ per gallon.

s. 480 lb. barley at 62 ¢ per bushel of 48 lb.

t. 200 gal. oil at 3 ¢ per quart.

u. 100 rods wire at 2 ¢ per foot.

Review of Fractions. Lowest Terms

Written Exercises

A fraction is reduced to lowest terms by dividing both terms by their G. C. D. When, however, a factor common to the numerator and the denominator is apparent, both terms are divided by a common factor until the terms are seen to be prime to each other.

1. Express $\frac{144}{180}$ in its lowest terms.

PROCESS

$\frac{144}{180} = \frac{72}{90} = \frac{8}{10} = \frac{4}{5}$. *Ans.* or $\frac{144}{180} = \frac{16}{20} = \frac{4}{5}$. *Ans.*

---

2. Reduce to lowest terms:

$a.\ \frac{126}{168}$ $b.\ \frac{168}{192}$ $c.\ \frac{165}{180}$ $d.\ \frac{135}{162}$

$e.\ \frac{150}{225}$ $f.\ \frac{126}{210}$ $g.\ \frac{128}{224}$ $h.\ \frac{336}{432}$

$i.\ \frac{288}{320}$ $j.\ \frac{168}{308}$ $k.\ \frac{180}{432}$ $l.\ \frac{208}{256}$

3. Reduce $\frac{299}{391}$ to its lowest terms.

As 299 is not an even number, it is not divisible by 2; the sum of its digits being 20, it is not divisible by 3; not ending in 5, it is not divisible by 5; etc. In this case the G. C. D. is found by continued division to be 23.

NOTE. — A number is divisible by 3 when the sum of its digits is divisible by 3.

4. Reduce $\frac{475}{855}$ to its lowest terms:

In this case both terms are divisible by 5, which reduces the fraction to $\frac{95}{171}$. To ascertain if 95 and 171 have a common divisor, test by the method of continued division. (See p. 134.)

5. Reduce to lowest terms:

$a.\ \frac{205}{246}$ $b.\ \frac{129}{172}$ $c.\ \frac{118}{177}$ $d.\ \frac{188}{231}$

$e.\ \frac{148}{185}$ $f.\ \frac{124}{217}$ $g.\ \frac{115}{184}$ $h.\ \frac{116}{261}$

Adding Mixed Numbers

Written Exercises

1. How many square feet are there in five steel plates containing, respectively, $12\frac{7}{8}$ sq. ft., $48\frac{1}{6}$ sq. ft., $9\frac{2}{8}$ sq. ft., $70\frac{5}{9}$ sq. ft., and $3\frac{7}{16}$ sq. ft.?

LEAST COMMON MULTIPLE

When the least common denominator cannot readily be determined by inspection, write the denominators in a horizontal row.

$$2\overline{)\;\cancel{9}-6-\cancel{8}-9-16}$$
$$\cancel{3}\quad\;\;9\quad\;8$$
$$2\times 9\times 8 = 144 \;\;(\text{L. C. M.})$$

Cancel one 9; also 8, which is a factor of 16. Divide by the smallest number which is a factor of more than one of the denominators, 2 in this case. Under 6 and 16 write 3 and 8 (their respective quotients), and bring down 9, which is not a multiple of 2. Cancel 3, which is a factor of 9. Since 9 and 8 (the remaining numbers) have no common factor, multiply 72 (their product) by 2 (the divisor), which gives 144 as the least common multiple of the denominators.

---

2. Find sums:

a. $\quad 6\frac{4}{9}$
$\quad\;\; 20\frac{7}{15}$
$\quad\;\; 12\frac{3}{20}$

b. $\;\; 10\frac{4}{7}$
$\quad\; 20\frac{3}{4}$
$\quad\;\; 6\frac{5}{12}$

c. $\;\; 18\frac{7}{20}$
$\quad\; 26\frac{3}{10}$
$\quad\;\; 5\frac{2}{9}$

d. $\;\; 23\frac{5}{6}$
$\quad\; 14\frac{7}{9}$
$\quad\;\; 8\frac{3}{20}$

e. $18\frac{1}{2}$
$\quad 24\frac{3}{4}$
$\quad 16\frac{4}{5}$
$\quad 36\frac{7}{10}$

f. $\;\; 7\frac{1}{2}$
$\quad 33\frac{5}{8}$
$\quad\; 6\frac{7}{10}$
$\quad 21\frac{8}{15}$

g. $13\frac{3}{4}$
$\quad\; 6\frac{3}{8}$
$\quad 17\frac{5}{9}$
$\quad 32\frac{3}{8}$

h. $27\frac{5}{24}$
$\quad 11\frac{7}{8}$
$\quad\; 1\frac{5}{9}$
$\quad\; 8\frac{7}{12}$

i. $\quad 6\frac{3}{4}$
$\quad 17\frac{2}{5}$
$\quad\;\; 8\frac{3}{8}$
$\quad 11\frac{5}{16}$

j. $\;\; 62\frac{1}{2}$
$\quad\;\; 7\frac{2}{3}$
$\quad 48\frac{3}{7}$
$\quad\;\; 5\frac{4}{15}$

k. $13\frac{5}{9}$
$\quad 23\frac{3}{16}$
$\quad\; 6\frac{7}{18}$
$\quad\; 8\frac{1}{3}$

l. $\quad 6\frac{1}{3}$
$\quad 28\frac{2}{9}$
$\quad 30\frac{3}{7}$
$\quad\; 5\frac{5}{14}$

Multiplication and Division Drills

1. Give products :

a. $\frac{1}{2}$ of 96   *b.* $\frac{1}{4}$ of 96   *c.* $\frac{1}{8}$ of 96   *d.* $\frac{1}{6}$ of 96   *e.* $\frac{1}{3}$ of 96

f. $\frac{2}{3}$ of 48   *g.* $\frac{3}{4}$ of 96   *h.* $\frac{5}{6}$ of 48   *i.* $\frac{3}{8}$ of 96   *j.* $\frac{5}{8}$ of 96

k. $\frac{1}{8}$ of 96   *l.* $\frac{1}{2}$ of 62   *m.* $\frac{2}{3}$ of 36   *n.* $\frac{3}{5}$ of 45   *o.* $\frac{5}{9}$ of 81

p. $\frac{1}{2}$ of 97   *q.* $\frac{1}{4}$ of 35   *r.* $\frac{1}{8}$ of 75   *s.* $\frac{1}{8}$ of 98   *t.* $\frac{3}{7}$ of 84

2. Divide :

a. $\frac{2}{5}$ by 2   *b.* $\frac{3}{8}$ by 2   *c.* $1\frac{1}{4}$ by 2   *d.* $1\frac{1}{2}$ by 2   *e.* $1\frac{1}{3}$ by 6

f. $\frac{3}{4}$ by 3   *g.* $\frac{3}{4}$ by 4   *h.* $2\frac{1}{2}$ by 5   *i.* $1\frac{1}{3}$ by 3   *j.* $3\frac{1}{3}$ by 4

k. $\frac{5}{6}$ by 5   *l.* $\frac{5}{6}$ by 7   *m.* $3\frac{1}{2}$ by 4   *n.* $1\frac{1}{4}$ by 4   *o.* $1\frac{1}{2}$ by 9

p. $\frac{9}{8}$ by 4   *q.* $\frac{2}{3}$ by 5   *r.* $4\frac{1}{2}$ by 3   *s.* $1\frac{1}{5}$ by 5   *t.* $3\frac{3}{5}$ by 8

3. Give quotients :

a. $2\overline{)24\frac{2}{6}}$ *b.* $3\overline{)30\frac{3}{5}}$ *c.* $4\overline{)48\frac{4}{7}}$ *d.* $5\overline{)45\frac{5}{6}}$

e. $6\overline{)66\frac{6}{7}}$ *f.* $2\overline{)24\frac{1}{2}}$ *g.* $3\overline{)30\frac{3}{4}}$ *h.* $4\overline{)40\frac{4}{5}}$

i. $5\overline{)40\frac{2}{3}}$ *j.* $6\overline{)60\frac{1}{2}}$ *k.* $2\overline{)21\frac{1}{4}}$ *l.* $3\overline{)31\frac{1}{5}}$

m. $4\overline{)41\frac{2}{5}}$ *n.* $5\overline{)41\frac{1}{9}}$ *o.* $6\overline{)61\frac{1}{5}}$ *p.* $2\overline{)23\frac{1}{4}}$

Relation of Numbers

4. State what fraction (proper or improper) :

a. 24 is of 18   *b.* 18 is of 24   *c.* 40 is of 24   *d.* 24 is of 40

e. 24 is of 36   *f.* 36 is of 24   *g.* 35 is of 28   *h.* 28 is of 35

5. State what number increased :

a. By $\frac{1}{2}$ of itself is 24   *b.* By $\frac{1}{3}$ of itself is 24

c. By $\frac{1}{4}$ of itself is 20   *d.* By $\frac{1}{5}$ of itself is 24

6. State what number diminished :

a. By $\frac{1}{2}$ of itself is 44   *b.* By $\frac{2}{3}$ of itself is 33

c. By $\frac{3}{4}$ of itself is 32   *d.* By $\frac{4}{5}$ of itself is 21

Written Problems

1. Mr. Kelly has sold $\frac{13}{16}$ of his farm of 336 acres. How many acres has he left?

2. After completing $\frac{3}{4}$ of her reader a girl has read 156 pages. How many pages are there in the reader?

3. Of a drove of 96 pigs 68 are black. What fraction of the drove consists of black ones?

4. After buying $\frac{1}{4}$ as many yards of carpet as he had, a dealer has 240 yards; how many yards had he before?

5. By selling a wagon for $108, a woman loses $\frac{1}{7}$ of the cost. What did it cost?

6. In a school there are 175 boys and 200 girls. What fraction of the pupils are (*a*) boys? (*b*) Girls?

7. When he has gone $27\frac{3}{4}$ miles a boy has still $\frac{1}{4}$ of the distance to go. (*a*) How far has he yet to go? (*b*) What is the length of the whole journey?

Sight Problems

1. The owner of a farm of 400 acres sells $\frac{2}{8}$ of it. How many acres does he sell?

2. John has read $\frac{3}{4}$ of his book. If he has read 120 pages, how many pages are there in the book?

3. Of a flock of 64 geese 48 are white. What fraction of the flock consists of white geese?

4. After buying $\frac{1}{2}$ as many marbles as he had, a boy has 42 marbles. How many had he at first?

5. By selling a wagon for $120, a man loses $\frac{1}{8}$ of the cost. What did it cost?

6. William and Mary divided some cherries, the former taking 35 and the other 40. What fraction does each receive?

Aliquot Parts of a Dollar

Preparatory Exercises

1. How many cents are there (*a*) in \$$\frac{1}{3}$? (*b*) In \$$\frac{1}{8}$?

2. What part of a dollar is (*a*) $16\frac{2}{3}$¢? (*b*) $33\frac{1}{3}$¢?

3. At \$$\frac{1}{3}$ per yard, how many dollars will be paid for
(*a*) 36 yards? (*b*) 69 yards? (*c*) 96 yards?

4. At \$$\frac{1}{6}$ per pound, how much will be the cost of
(*a*) 48 pounds? (*b*) 66 pounds? (*c*) 126 pounds?

Written Exercises

1. Find the cost of 48 yards of cloth (*a*) at \$2.16$\frac{2}{3}$ per
yard. (*b*) At \$2.33$\frac{1}{3}$.

(*a*) \$$2\frac{1}{6}$	**PROCESS**	(*b*) \$$2\frac{1}{3}$
$\times 48$	In (*a*) multiply 48 by	$\times 48$
8	$2\frac{1}{6}$. In (*b*) multiply 48	16
96	by $2\frac{1}{3}$.	96
\$104 *Ans.*		\$112 *Ans.*

2. Find answers:

 a. \$2.33$\frac{1}{3}$ *b.* \$3.16$\frac{2}{3}$ *c.* \$4.33$\frac{1}{3}$ *d.* \$5.16$\frac{2}{3}$
   $\times 66$ $\times 48$ $\times 84$ $\times 96$

Sight Exercises

Give products:

 a. \$0.16$\frac{2}{3}$ *b.* \$0.25   *c.* \$0.33$\frac{1}{3}$ *d.* \$0.50   *e.* \$0.12$\frac{1}{2}$
   $\times 96$ $\times 96$ $\times 96$ $\times 96$ $\times 96$

 f. \$0.12$\frac{1}{2}$ *g.* \$0.25   *h.* \$0.16$\frac{2}{3}$ *i.* \$0.50   *j.* \$0.33$\frac{1}{3}$
   $\times 72$ $\times 92$ $\times 84$ $\times 98$ $\times 69$

Preparatory Exercises

1. At $\frac{1}{3}$ of a dollar per pair, how many pairs of stockings can be bought (*a*) for $1? (*b*) For $2? (*c*) For $10?

2. At $16\frac{2}{3}$ cents each, how many collars can be bought (*a*) for $1? (*b*) For $2? (*c*) For $4?

Sight Exercises

Give quotients:

a. $\frac{1}{3}$)$63   *b.* $\frac{1}{6}$)$31   *c.* $\frac{1}{4}$)$62   *d.* $\frac{1}{8}$)$31

e. $\frac{1}{3}$)21\frac{1}{3}$ *f.* $\frac{1}{6}$)12\frac{1}{6}$ *g.* $\frac{1}{3}$)22\frac{2}{3}$ *h.* $\frac{1}{6}$)12\frac{1}{6}$

i. $\frac{1}{8}$)12\frac{1}{2}$ *j.* $\frac{1}{4}$)12\frac{1}{2}$ *k.* $\frac{1}{6}$)12\frac{1}{2}$ *l.* $\frac{1}{6}$)12\frac{2}{3}$

Written Exercises

1. At $16\frac{2}{3}$ cents per yard, how many yards can be bought (*a*) for $37\frac{1}{2}$? (*b*) For $45\frac{1}{3}$? (*c*) For $87\frac{1}{2}$?

PROCESS

    (*a*)   (*b*)   (*c*)

$.16\frac{2}{3}$)$37\frac{1}{6}$ $.16\frac{2}{3}$)$45\frac{1}{3}$ $.16\frac{2}{3}$)$87\frac{1}{2}$

Ans. 223 (yd.)   *Ans.* 272 (yd.)   *Ans.* 525 (yd.)

  (*a*) The quotient of $37\frac{1}{6}$ by $\frac{1}{6}$ is 6 times $37\frac{1}{6}$.
  (*b*) The quotient of $45\frac{1}{3}$ by $\frac{1}{6}$ is 6 times $45\frac{1}{3}$.
  (*c*) The quotient of $87\frac{1}{2}$ by $\frac{1}{6}$ is 6 times $87\frac{1}{2}$.

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2. At 3 pairs for a dollar, how many pairs of stockings can be bought for (*a*) $37\frac{1}{3}$? (*b*) $48\frac{2}{3}$?

3. Find quotients:

a. $.12\frac{1}{2}$)$23\frac{1}{4}$ *b.* $.16\frac{2}{3}$)$37\frac{1}{2}$ *c.* $.33\frac{1}{3}$)$48\frac{2}{3}$

d. $.16\frac{2}{3}$)$23\frac{2}{3}$ *e.* $.33\frac{1}{3}$)$68\frac{1}{3}$ *f.* $.16\frac{2}{3}$)$48\frac{5}{6}$

Sight Problems

1. (*a*) How many pounds will 125 bushels of corn weigh at 56 pounds to the bushel? (*b*) Give weight in tons and a decimal.

2. Find the cost of 28 baseballs at $1.25 each.

3. At 125 nails to the pound, how many nails will weigh 32 pounds?

4. What is the cost of 3125 bricks at $8 per thousand?

5. How many square rods are there in a field 64 rods wide, 125 rods long?

6. What is the annual salary of a man that receives $125 per month?

7. Find the freight on 96 tons of coal at $1.12½ per ton.

8. At 128 cubic feet to the cord, how many cubic feet are there in 125 cords of wood?

9. In a school of 200 pupils, there are 98 girls. How many more boys are there than girls?

10. How many eggs will 125 hens lay in a year at an average of 84 eggs each?

11. At 125 ears of corn to a bushel, how many ears would make 80 bushels?

12. How wide is a building lot 125 feet deep when it contains 24,000 square feet?

13. What is the cost of 8 dozen baseballs at 75 cents each?

14. At 25 cents per dozen what would be received for the eggs of 10 hens if each laid 120 eggs?

15. A farmer obtained 75 tons of alfalfa at the first cutting and 59 at the second. How many tons did he obtain at both?

Written Problems

1. How many tons will 125 barrels of apples weigh when each barrel contains 2½ bushels of 50 pounds each?

2. Find the cost of 36 dozen catchers' gloves at $1.25 apiece.

3. At 4 nails to the square foot, how many pounds of nails will be required to lay a floor 50 feet long, 40 feet wide, when there are 125 nails to the pound?

4. Find the cost of 15,625 pressed brick at $14 per thousand.

5. How many acres are there in a field 125 rods long, 64 rods wide?

6. How much does a man save in a year when his monthly salary is $125, and his expenses are .84 of his salary?

7. What is the freight on 964 tons of coal at $1.12½ per ton?

8. Find the weight in tons of 125 cords of wood weighing 40 pounds to the cubic foot.

9. In a school of 975 pupils there are 493 boys. How many fewer girls are there than boys?

10. At an average of 25 cents per dozen, what will be received for the eggs of 125 hens if each lays on an average 120 eggs?

11. Assuming 3000 hills to an acre and 3 ears of corn to a hill, how many bushels of corn will be produced on an acre when 100 ears make a bushel?

12. Change .375 yd. (*a*) to feet and a decimal. (*b*) to inches and a decimal.

13. Change 2⅔ hours to the fraction of a day.

Bills and Accounts

A *bill* is a written statement made out by the seller of goods and sent to the buyer.

It shows the date of each purchase, the quantity of each article, the price of each, the total cost of each, and the total amount of the bill.

Copy the following bill, filling out the missing items: (*a*), (*b*), (*c*), (*d*), and (*e*).

COVINGTON, KY., Nov. 30, 1914

REGAN, REILLY, & Co.

487 Market St.

Sold to MRS. J. J. CASHMAN

70 Rutland Road

Nov.	3	1 bag Coffee, 130 lb. .14	(a)				
		(b) doz. Corn 1.80	4	50			
	8	30 lb. Sugar (c)	1	65			
	22	1 bbl. Flour	(d)				
	29	1 bu. Apples	1	50			
	"	5½ lb. Butter .32	(e)				
						$34	11
		Received payment					
		Dec. 1, 1914					
		Regan, Reilly, & Co.					
		per E. McG.					

The total cost of each item, which is placed in the first double column, is called an *extension*, the total amount of the bill, which is placed in the second double column, is called the *footing*.

When a bill is receipted by a clerk, he writes his initials below the name of the firm.

Written Exercises

Make out bills for the following purchases, supplying names, dates, etc.

1. 12 yd. Silk at $1.20; 6 spools of Thread at 8¢, 24 yd. Lining at 12½¢; 3 papers Needles at 2¢, 1 Hat for $4.50, 2 pr. Gloves at $1.75, 3 pcs. Braid at 35¢.

2. 24 yd. Carpet at $1.25, 1 Rug for $16.25, 4 Chairs at $1.50, 1 Table for $18.75, 2 Mats at 75¢.

3. 16 lb. Ham at 12½¢, 25 lb. Meal at 2¢, 1 kit Mackerel for $1.75, 24 gal. Oil at 16¢, 4 bars Soap at 22¢.

Statement of Account

BUFFALO, N.Y., DEC. 1, 1915

MR. WM. KENTLER

1420 Broad St.

To JOHN McNAMEE, Dr.

Nov.	*10*	*To 4 bdl. Shingles $1.25* " *6 lb. Nails* *.15* " *3 da. Labor* *3.00* *Cr.*			*(a)*
Nov.	*13*	*By Cash*	*5*	*—*	
Nov.	*25*	" *3 bu. Potatoes* *.75*			*(b)*
		Balance due			*(c)*

4. Copy the foregoing statement, supplying missing extensions, also items (*a*), (*b*), and (*c*).

A charge for goods, etc., is called a *debit*, and is preceded by the word " To "; an allowance for money, goods, etc., is called a *credit*, and is preceded by the word " By ". The foregoing bill contains three debit and two credit items.

Written Exercises

Make out statements as follows, giving credits as specified. Supply names and dates.

1. Debits: 14 ft. pipe at 7¢; 2 lb. solder at 23½¢; 1 bowl for $.50; labor 3 da. at $3.50.

Credits: 2 lb. tea at 60¢; 3 lb. coffee at 28¢; 1 bag flour for 75¢.

2. Debits: 24 roses at 25¢; 16 geraniums at 10¢; 4 doz. hyacinths at 50¢; 10 doz. crocuses at 25¢; ½ da. labor at $3; fertilizer, 50¢.

Credits: Cash, $5; 3 bu. potatoes at 60¢.

Receipts

When Mr. Kentler paid $5 to Mr. McNamee on Nov. 13, as shown in the statement on p. 155, he was entitled to an acknowledgment, which would be made out in the following form:

Receipt on Account

BUFFALO, N.Y., Nov. 13, 1915

Received of Wm. Kentler, Five $\frac{00}{100}$ Dollars, on account. JOHN McNAMEE

5\frac{00}{100}$

When he paid the balance due, Mr. Kentler would obtain the following receipt in case he did not present the statement to be receipted and if he did not owe McNamee any additional sum.

Receipt in Full

BUFFALO, N.Y., DEC. 5, 1915

Received of Wm. Kentler, Seven $\frac{65}{100}$ Dollars, in full of account to date. JOHN McNAMEE

7\frac{65}{100}$

Rent Receipt

NEWARK, N.J., MAY 1, 1916

Received of Mr. M. A. Ahern, Fourteen $\frac{50}{100}$ Dollars, in full of rent of house No. 865 Fourteenth St., to May 31, 1916. MAGNUS SCHULER

14\frac{50}{100}$ .PER M. E. K.

It will be observed that the sum paid is written twice, the number of *dollars* being first given in words, then in figures. The *cents* are expressed in both places as hundredths of a dollar.

Receipts of payment for services rendered, etc., are made in the same form as the foregoing, and they may be either receipts in full or receipts on account.

The following items should appear in a receipt.

1. The place and the date.
2. The name of the person for whose benefit the money is paid (the debtor).
3. The sum paid.
4. The account to which the payment is applied.
5. A statement showing that the indebtedness is wholly settled or only partially settled.
6. The signature of the person to whom the money is due (the creditor).

When the money is received by a clerk, etc., the latter adds his initials to the name of the creditor, as in the case of a receipt on a bill.

Written Exercises

1. Copy the foregoing receipts.
2. Write a receipt for a part of a month's rent (receipt on account).
3. Write a mechanic's receipt for labor performed and materials furnished.

Furnishing a House

Mrs. Farley has \$250 with which to furnish an apartment of five rooms, stoves being supplied by the owner. She pays for kitchen utensils as follows:

Table	\$2.00	Meat knife	\$.50
Chairs	1.50	Knife stone	.15
China	4.00	Broiler	.10
Silver	2.50	Corkscrew	.12
Table linen	15.00	Frying pan	.10
Ice box	7.00	Roasting pan	.10
Sadirons	1.25	Egg beater	.08
Wash boiler	1.60	Layer pans	.10
Saucepans (2)	.90	Funnel	.10
Soup kettle	.75	Chopping knife	.15
Saucepans (2)	.50	Can opener	.10
Coffee pot	.50	Vegetable knife	.05
Broom	.40	Pie pans (2)	.12
Teapot	.30	Pudding pan	.10
Muffin pan	.20	Tea strainer	.10
Scrub pail	.25	Grater	.06
Dustpan and brush . . .	.50	Cake turner	.06
Stove brush	.25	Potato masher	.05
Chopping bowl	.20	Washboard	.26

Written Exercises

1. Find the total. How much remains for the other four rooms?

2. She allows for the furniture of each of the two bedrooms \$3 less than one-fourth of the remainder. For each she buys the following articles:

Blankets	\$4.75	Pillows	\$1.50
Sheets	1.50	Comforter	1.00
Pillow cases	.75	Towels	1.50
Spread	1.00	Bath Towels	1.00

Find the total of these items.

3. Make out a list of the bedroom furniture, with the prices, that will not exceed the sum allowed.

4. She allows $1 more than the average for the dining room furniture. Make out the list with the prices.

5. Make out a list of the furniture that can be bought for the living room, with the remainder of the money.

The following are minimum prices for some articles:

Chairs $0.75	Curtains $2.00
Dining table 5.50	Rocker 1.75
Sideboard 10.00	Mattress 6.00
Center table 6.00	Spring 2.00
Rug 7.50	Dresser 8.00
Bed 1.75	Pictures 1.00

6. A man works 305 days in a year at $3 per day. He spends $\frac{1}{6}$ of his earnings for rent. What is his rent per month?

7. (*a*) How many square feet of linoleum will be needed to cover the floor of a kitchen 14 ft. long, 13 ft. 6 in. wide? (*b*) How many square yards? (*c*) Find the cost at 85 cents per square yard.

8. A man that earns $900 per year spends .2 of this sum for rent, .25 for food for his family, .2 for clothing, .15 for car fares, mending, coal, etc. How much is left for other purposes?

SECTION IV

DENOMINATE NUMBERS, PERCENTAGE, INTEREST, DECIMALS, MEASUREMENTS, REVIEWS, SHORT METHODS, ACCOUNTS

Compound Denominate Numbers

Preparatory Exercises

1. A girl measured the width of a piece of cloth with a yard stick, and found it to be 1 yd. 1 ft. 6 in. wide. What is the width (*a*) in feet and inches? (*b*) In feet and the fraction of a foot? (*c*) In yards and the fraction of a yard? (*d*) In inches?

2. What fraction of a yard wide is a strip of silk that is (*a*) 27 inches wide? (*b*) 2 ft. 3 in. wide?

3. When an ounce of tea is used daily, (*a*) how many ounces are used in June? (*b*) Give the weight in pounds and ounces. (*c*) In pounds and the fraction of a pound.

Concrete numbers relating to units of measure; such as 3 ounces, 2 feet, 6 inches, 4 pounds, etc., are called *denominate* numbers.

Denominate numbers containing a single unit, such as 3 oz., 2 ft., $4, 5 bu., etc., are called *simple denominate numbers*. Those containing two or more related units; such as 5 lb. 3 oz., 1 yd. 2 ft. 6 in., 7 A. 80 sq. rd., are called *compound denominate numbers*, or merely *compound numbers*.

Reductions

Preparatory Exercises

1. Change to ounces :

a. 20 lb.   *b.* 3 lb.   *c.* $\frac{3}{4}$ lb.   *d.* 1.25 lb.   *e.* $1\frac{1}{2}$ lb.
f. 1 lb. 9 oz.

Sight Exercises

2. Change :

a. 2 yd. 1 ft. to feet.	*b.* $\frac{2}{3}$ yd. to feet.
c. .25 bu. to pecks.	*d.* 2 bu. 2 pk. to pecks.
e. $\frac{3}{4}$ lb. to ounces.	*f.* .5 hr. to minutes.
g. 2 yd. 1 ft. to inches.	*h.* $\frac{1}{8}$ bu. to quarts.
i. .75 ft. to inches.	*j.* 5 lb. 7 oz. to ounces.
k. $\frac{2}{3}$ da. to hours.	*l.* .42 T. to pounds.
m. 2 bu. 2 pk. to quarts.	*n.* $\frac{3}{4}$ yd. to inches.
o. .75 lb. to ounces.	

Reduction Descending

1. How many nails 1 inch long can be made from a piece of wire measuring (*a*) 12 yd. 2 ft. 6 in. ?   (*b*) 17 yd. 2 ft. ?   (*c*) 16 yd. 9 in. ?

PROCESS

(*a*)
   12 (yd.) 2 (ft.) 6 (in.)
   × 3 ft.
   ―――――――――
     38 (ft.)
   × 12 in.
Ans. 462 (nails)

Since there are 3 feet in a yard, in 12 yards there are 12 times 3 ft., or 36 ft., and in 12 yd. 2 ft. there are 38 ft. Since there are 12 inches in a foot, in 38 feet there are 38 times 12 in., or 456 in., and in 38 ft. 6 in. there are 462 in.

In doing the work, however, use 3 as the first multiplier, and "add in" 2 ft. while performing the multiplication. Then multiply 38 by 12, and "add in" 6 inches.

Written Exercises

2. Reduce:

a. 13 yd. 1 ft. 7 in. to inches.   *b.* 16 yd. 2 ft. to inches.

c. 3 mi. 20 rd. 4 yd. to yards.   *d.* 20 rd. 4 ft. to feet.

e. 16 bu. 2 pk. 7 qt. to quarts.   *f.* 26 bu. 3 pk. to quarts.

Reduction Ascending

Written Exercises

1. How many yards, etc., are there in a piece of muslin measuring (*a*) 462 in ?   (*b*) 636 in. ?   (*c*) 585 in. ?

PROCESS

(*a*) 12 in.)462 in.   Since there are 12 in.
      3 ft.)38 (ft.) 6 in.   in a foot, divide 462 in.
        12 (yd.) 2 ft. 6 in.   by 12 in., which gives
                                  the number of feet as 38,
with a remainder of 6 in. After 38 write ft. in a parenthesis.
Since there are 3 ft. in a yard, divide 38 ft. by 3 ft., which gives
the number of yards as 12, with a remainder of 2 ft. After 12,
write yd. in a parenthesis. Bring down 6 in.

(*b*) 12 in.)636 in.   (*c*) 12 in.)585 in.
       3 ft.)53 (ft.)   3 ft.)48 (ft.) 9 in.
     Ans. 17 (yd.) 2 ft.   16 (yd.) 9 in.

---

2. Reduce to higher denominations :

a. 189 in.   *b.* 284 oz.   *c.* 3700 sec.   *d.* 147 pt. (liquid)

e. 168 hr.   *f.* 275 mo.   *g.* 3700 min.   *h.* 215 qt. (dry)

Sight Exercises

Change to higher denominations :

a. 64 oz.   *b.* 70 oz.   *c.* 160 oz.   *d.* 170 oz.   *e.* 150 min.

f. 50 hr.   *g.* 80 hr.   *h.* 108 ft.   *i.* 110 ft.   *j.* 370 sec.

k. 48 mo.   *l.* 63 mo. *m.* 120 mo.   *n.* 126 mo.   *o.* 100 mo.

Sight Problems

1. What is the profit on a 10-gallon can of milk bought at $2 per can, and sold at 8¢ per quart?

2. How much is received for a bushel of chestnuts sold at 5 cents a pint?

3. How many steps of 30 inches each are taken in going a block of 200 feet?

4. Change 250 pounds to the decimal of a ton.

5. At $6 per ton what is the cost of 600 pounds of coal?

6. If 12 bottles of catsup contain $2\frac{1}{4}$ gallons, how many pints does each contain?

7. What would a mile of fence cost at the rate of $1.25 per rod?

Written Problems

1. What is the profit on 20 10-gallon cans of milk bought at 20 cents per gallon, if $\frac{9}{10}$ of the milk is sold at 8 cents per quart and $\frac{1}{10}$ of it is sold at 4 cents per quart?

2. A dealer buys $2\frac{1}{2}$ bushels of chestnuts for $1.80 per bushel, and sells them at 10 cents per quart; what is his profit?

3. How many steps at $2\frac{1}{2}$ feet each are taken in going a mile?

4. Change 578 pounds to the decimal of a ton.

5. At $6 per ton, what is the cost of 675 pounds of coal?

6. A man bought 45 gallons of catsup. How many bottles will hold it, if 12 bottles contain $2\frac{1}{4}$ gallons?

7. Find the cost of a mile of fencing at the rate of 15 cents a yard.

Operations with Compound Numbers — Addition and Multiplication

Written Exercises

1. A tailor used 4 yards of cloth in making an overcoat, 8 yd. 6 in. for an inside coat, 2 yd. 2 ft. for the trousers, and 1 ft. 9 in. for the vest. How much cloth did he use?

<table>
<tr><th colspan="2">PROCESS</th></tr>
<tr><td>4 yd.
3 yd.   6 in.
2 yd. 2 ft.
    1 ft. 9 in.
Ans. 10 yd. 1 ft. 3 in.</td><td>Write numbers in columns, the same denomination in the same vertical column. Beginning at the right, find the sum of the first column, which is 15 in. or 1 ft. 3 in. Write 3 in. and carry 1 ft. to the next column. The sum of</td></tr>
</table>

this column, including the 1 ft. carried, is 4 ft. or 1 yd. 1 ft. Write 1 ft. and carry 1 yd.

2. Add the following:

a. 6 yd. 2 in., 2 ft. 11 in., 4 yd. 2 ft., and 3 yd. 1 ft. 6 in.

b. 4 bu. 3 pk. 6 qt., 2 pk. 4 qt., 7 bu. 6 qt., and 3 pk. 4 qt.

c. 3 gal. 1 pt., 4 gal. 3 qt. 1 pt., 7 gal. 2 qt., and 1 gal. 1 qt. 1 pt.

3. When it requires 4 yd. 10 in. of cloth for a boy's suit, how much is required (*a*) for 5 suits? (*b*) For 4?

Insert missing denomination: 4 yd. 0 ft. 10 in.

4. Find products:

a. 4 bu. 3 pk. 6 qt. by 3   *b.* 3 gal. 1 pt. by 5

c. 7 yd. 2 ft. 6 in. by 7   *d.* 2 bu. 3 qt. by 8

Subtraction

Written Exercises

1. How much wire is left (*a*) when 24 yd. 8 in. are taken from a coil originally containing 40 yd. 1 ft.? (*b*) When 35 yd. 8 in. are taken from a coil containing 50 yd. 6 in.? (*c*) When 46 yd. 1 ft. 10 in. are taken from one containing 60 yd. 1 ft. 3 in.?

PROCESS

(*a*) 40 yd. 1 ft.
    24 yd.   8 in.
    16 yd.   4 in.   *Ans.*

(*b*) 50 yd.   6 in.
    35 yd.   8 in.
    14 yd. 2 ft. 10 in.   *Ans.*

(*c*) 60 yd. 1 ft.   3 in.
    46 yd. 1 ft. 10 in.
    13 yd. 2 ft.   5 in.   *Ans.*

(*a*) Think 8 in. and **4 in.** (writing 4 in.) are 1 ft. Carrying 1 ft., think 1 ft. and **0 ft.** are 1 ft., etc. *Test.*

(*b*) Think 8 in. and **10 in.** (writing 10 in.) are 1 ft. 6 in. Carrying 1 ft., think 1 ft. and **2 ft.** (writing 2 ft.) are 1 yd. Carrying 1 yd., think 36 yd. and **14 yd.** (writing 14 yd.) are 50 yd. *Test.*

. (*c*) Think 10 in. and **5 in.** (writing 5 in.) are 1 ft. 3 in. Carrying 1 ft., think 2 ft. and **2 ft.** (writing 2 ft.) are 1 yd. 1 ft. Carrying 1 yd., think 47 yd. and **13 yd.** (writing 13 yd.) are 60 yd. *Test.*

---

2. Subtract:

a. From 40 yd. take 24 yd. 8 in.

b. From 60 gal. take 18 gal. 3 qt. 1 pt.

c. From 84 bu. 2 pk. take 19 bu. 3 qt.

d. 48 yr. 6 mo. 7 da. − 9 yr. 8 mo. 9 da.

e. 72 yd. 1 ft. 4 in. − 57 yd. 2 ft. 8 in.

f. 16 wk. 4 da. 7 hr. − 8 wk. 5 da. 20 hr.

Division — Abstract Divisors

Preparatory Exercises

1. Divide by 4:

a. 1 lb.   *b.* 2 lb.   *c.* 1 lb. 4 oz.   *d.* 5 lb. 4 oz.

2. Give quotients :

a. 4)8 lb. 4 oz.   *b.* 4)9 lb.   *c.* 4)9 lb. 8 oz.

Written Exercises

1. What is the length of each piece, if 8 pieces are made from a bar of iron whose length is

(*a*) 48 yd. 2 ft.? (*b*) 49 yd. 4 in.? (*c*) 51 yd. 1 ft. 8 in.?

PROCESS

(*a*) 8)48 yd. 2 ft.
Ans.   6 yd.   3 in.
(*b*) 8)49 yd. 0 ft. 4 in.
Ans.   6 yd.   5 in.
(*c*) 8)51 yd. 1 ft. 8 in.
Ans.   6 yd. 1 ft. 4 in.

(*a*) 48 yd. ÷ 8 = 6 yd.
    2 ft. ÷ 8 = 24 in. ÷ 8 = 3 in.
(*b*) 49 yd. ÷ 8 = 1 yd., and remainder 1 yd., or 3 ft., or 36 in.
Add this to 4 in. which gives 40 in.
    40 in. ÷ 8 = 5 in.
(*c*) 51 yd. ÷ 8 = 6 yd., and remainder 3 yd., or 9 ft. Add this to 1 ft. which gives 10 ft. 10 ft. ÷ 8 = 1 ft. and remainder 2 ft., or 24 in. Add this to 8 in. which gives 32 in. 32 in. ÷ 8 = 4 in.

---

2. Find quotients :

a. 15 weeks ÷ 9   *b.* 13 wk. 6 da. 8 hr. ÷ 4

c. 27 yards ÷ 6   *d.* 87 yd. 1 ft. 6 in. ÷ 5

e. 49 bushels ÷ 8   *f.* 49 bu. 2 pk. 3 qt. ÷ 6

3. Find answers:

a. $\frac{2}{3}$ of 13 years   *b.* $\frac{3}{4}$ of 9 yr. 6 mo. 12 da.

c. $\frac{5}{6}$ of 25 years   *d.* $\frac{1}{4}$ of 2 yd. 1 ft. 6 in.

e. $\frac{3}{4}$ of 49 bushels   *f.* $\frac{2}{3}$ of 7 bu. 2 pk. 6 qt.

Denominate Divisors

Preparatory Exercises

1. Tell what part of a day is (*a*) 6 hours.   (*b*) 8 hours.
(*c*) 1 hour.   (*d*) 30 minutes.

2. Divide 4 years (*a*) by 1 yr.   (*b*) by 6 mo.   (*c*) by
1 yr. 4 mo.   (*d*) by 8 mo.

3. Divide 3 pounds (*a*) by 1 lb.   (*b*) by 12 oz.   (*c*) by
1 lb. 8 oz.   (*d*) by 8 oz.

To divide one denominate number by another, make
the divisor and the dividend of the *same denomination.*

It must be remembered that the quotient of a concrete divisor and
a concrete dividend is *abstract.*

$$16 \text{ oz.} \div 4 \text{ oz.} = 4 \qquad\qquad 24 \text{ yd.} \div 3 \text{ yd.} = 8$$

that is, 4 oz. is contained in 16 oz., 4 *times*, and 3 yd. is contained in
24 yd., 8 *times*.

Written Exercises

1. (*a*) When a suit contains 3 yd. 6 in. of cloth, how
many suits will 15 yd. 2 ft. 6 in. make?   (*b*) How many
pairs of trousers will 21 yd. make if each takes 2 ft. 4 in.?

PROCESS

(*a*) 15 yd. 2 ft. 6 in. ÷ 3 yd. 6 in. = 570 in. ÷ 114 in. = 5.
   Ans. 5 suits.

(*b*) 21 yd. ÷ 2 ft. 4 in. = 756 in. ÷ 28 in. = 27.   *Ans.* 27 pairs.

Reduce the divisor and the dividend to the lowest denomination
found in either.

2. Find quotients :

a. 10 yd. 2 ft. ÷ 2 ft. 8 in.   *b.* 16 bu. 2 pk. ÷ 1 pk. 3 qt.

c. 18 gal. 3 qt. ÷ 2 qt. 1 pt.   *d.* 17 wk. 1 da. ÷ 1 da. 6 hr.

Sight Problems

1. What day of the year is March 10, 1916?

2. How many hours and minutes are there in one tenth of a day?

3. How many nails can be made from a yard of wire when each nail requires $2\frac{1}{4}$ inches of wire?

4. Find the number of half pints in a half bushel.

5. (*a*) What decimal of an hour is 39 minutes? (*b*) What fraction?

6. How many posts placed 6 feet apart are needed (*a*) for a fence 6 feet long? (*b*) For a fence 12 ft. long? (*c*) For a fence 120 ft. long?

7. A man worked from the morning of June 1 to the evening of June 5; how many days did he work?

Written Problems

1. What day of the year is Nov. 28, 1916?

2. How many hours and minutes are there in .65 of a day?

3. How many nails can be made from 4 yards of wire if each nail requires $1\frac{1}{8}$ inches of wire?

4. Find the number of half pints in 1 bu. 1 pk. 1 qt. 1 pt.

5. (*a*) What decimal of an hour is 19 min. 30 sec.? (*b*) What fraction?

6. Including both end poles, how many telephone poles placed $7\frac{1}{2}$ rods apart are required for a line 3 miles long?

7. At the rate of $15 per month, how much does a man receive who begins work on the morning of Jan. 15 and stops after work on April 24?

Percentage

Preparatory Exercises

1. Five baseball clubs, A, B, C, D, and E, play 20 games each. A won 16 games. (*a*) What fraction of its games did it win? (*b*) What decimal? (*c*) How many hundredths?

B won 14 games. (*d*) How many hundredths of its games did it win?

C won 12 games. (*e*) What decimal did it win? (*f*) How many hundredths?

D won 6 games. (*g*) How many hundredths of its games did D win?

E won 2 games. (*h*) How many hundredths of its games did E win?

In transactions of various kinds, the expression *per cent* is used instead of the word *hundredths*.

The sign of per cent is %.

3 % means 3 hundredths, or .03; 25 % means 25 hundredths, or .25.

2. Copy the following table. Insert the number of games won by each club, the number lost by each club, and the per cent of defeats.

CLUB	GAMES PLAYED	PER CENT	GAMES WON	GAMES LOST	PER CENT LOST
A	20	80 %			
B	20	70 %			
C	20	60 %			
D	20	30 %			
E	20	10 %			

Written Exercises

1. A drover spent (*a*) $350 for sheep, which he sold at a profit of 6 %; (*b*) $437.50 for cows, which he sold at a profit of 8 %; and (*c*) $212 for hogs which he sold at a profit of 18 %. What was his profit on each kind of stock?

```
                              PROCESS
(a)  $350         .(b)  $437.50           (c)  $212
     × .06              × .08                  × .18
    ─────────          ──────────             ─────────
   $21.0̸0̸  Ans.      $35.0̸0̸0̸0̸  Ans.        $38.16  Ans.
```

Multiply by the per cent expressed as hundredths.

2. Find

a. 3 % of $1125.   *b.* 12 % of $560.   *c.* 35 % of 180 lb.

3. (*a*) A farmer sowed 180 bushels of wheat, of which $2\frac{1}{4}$ % failed to grow; how many bushels did not grow? (*b*) Last year's crop was 2320 bushels; this year's crop is 205 % of last year's. How many bushels are there in this year's crop?

```
                              PROCESS
(a)  180 bu.       (b)  2320 bu.      Write 2¼% and 205%
     × .02¼             2.05          as a two-place decimal
    ─────────          ──────────     in each case.
```

4. Find

a. $3\frac{1}{2}$ % of $234.   *b.* 85 % of 360 yd.   *c.* $104\frac{1}{2}$ % of 240 A.

d. $2\frac{1}{4}$ % of 64 bu.   *e.* 45 % of 280 ft.   *f.* $1\frac{1}{8}$ % of $176.

g. 60 % of 250 lb.   *h.* 250 % of 36 T.   *i.* 35 % of 150 yd.

Sight Exercises

1. Change the following per cents to fractions:

a. 2%   *b.* 10%   *c.* 12½%   *d.* 20%   *e.* 33⅓%

f. 4%   *g.* 25%   *h.* 16⅔%   *i.* 50%   *j.* 5%

2. Change the following fractions to per cents:

a. $\frac{1}{2}$ *b.* $\frac{1}{3}$ *c.* $\frac{1}{4}$ *d.* $\frac{1}{5}$ *e.* $\frac{1}{6}$ *f.* $\frac{1}{8}$ *g.* $\frac{1}{10}$ *h.* $\frac{1}{20}$

i. $\frac{1}{25}$ *j.* $\frac{1}{50}$ *k.* $\frac{3}{4}$ *l.* $\frac{2}{5}$ *m.* $\frac{4}{5}$ *n.* $\frac{3}{8}$ *o.* $\frac{9}{10}$ *p.* $\frac{3}{20}$

3. Using fractional equivalents for the per cents, give

a. 12½ %of 24 sheets. *b.* 25 % of 56 pages. *c.* 12½ % of $488.

d. 16⅔ % of 72 words. *e.* 50 % of 92 books. *f.* 33⅓ % of $159.

Written Exercises

1. A man has a farm of 640 acres. How many acres are there in corn when (*a*) 12½ % of the farm is in corn? (*b*) 16⅔ %? (*c*) 25 %? (*d*) 33⅓ %? (*e*) 50 %?

PROCESS
(*a*)   640 × .12½ *Ans.* 80 A. (*b*)   640 A. × .16⅔ *Ans.* 106⅔ A. (*c*)   640 A. × .25 *Ans.* 160 A.
(*d*)   640 A. × .33⅓ *Ans.* 213⅓ A. (*e*)   640 A. × .50 *Ans.* 320 A.   Write the per cents in each case as a two-place decimal but multiply by the equivalent fraction; ⅛ in (*a*), ⅙ in (*b*), ¼ in (*c*), etc.

2. Find

a. 12½ % of 264 lb.   *b.* 25 % of $369.   *c.* 16⅔ % of 999 yd.

d. 16⅔ % of $459.   *e.* 50 % of 378 A.   *f.* 33⅓ % of 744 ft.

g. 33⅓ % of 264 yd.   *h.* 25 % of $573.   *i.* 12½ % of 368 qt.

Sight Problems

1. A boy was absent 10 % of the 190 regular school days. (*a*) How many days was he absent? (*b*) How many days did he attend?

2. A girl missed 4 % of 50 spelling words. (*a*) How many did she miss? (*b*) How many did she spell correctly?

3. A farmer lost 6 % of his 200 sheep by disease. How many sheep did he lose?

4. A merchant deducted 2 % of the amount of Mr. Jones's bill for prompt payment. If the original bill was $ 60, how much was deducted?

5. To insure his house for $ 1500, Mr. Johnson paid ¼ of 1 % of this sum. How much did he pay?

6. For the use of $ 1200 for a year Mrs. Brown paid 4 % of the sum borrowed. How much did she pay at the end of the year including the $ 1200 borrowed?

7. A man whose house is valued at $ 2400 pays ¾ % of its value for taxes each year. How much are his yearly taxes?

8. A farmer has 1500 bushels of oats in the fall. How many bushels will he have in the spring if he loses 2 % of this quantity?

9. Last year's yield of hay on Mr. Ziegler's farm was 320 tons; this year's yield is 10 % more. What is this year's yield?

10. Of 50 pupils in a school 4 % are absent. How many are present?

11. In a year of 200 school days Mary was absent 2 days. (*a*) What fraction of the time was she absent? (*b*) What decimal? (*c*) What per cent?

Written Problems

1. How many days did a boy attend school who was absent $7\frac{1}{2}$ % of the 160 regular school days ?

2. A grocer sells goods costing $ 350, at an advance of 15 % on the cost. Find the selling price.

3. The population of a city was 45,250 one year ago ; it is 18 % greater this year. What is this year's population ?

4. Goods that are marked $ 480 are sold for 10 % below the marked price. What is the selling price ?

5. A house is insured for $ 4600, the rate being $\frac{3}{8}$ of 1 %. What is the cost of the insurance ?

6. Mr. Collins borrows $ 900 for a year for which he pays $4\frac{1}{2}$ % of the sum borrowed. How much does he owe at the end of the year ?

7. When the tax rate is $1\frac{1}{4}$ %, how much are the taxes on a house valued at $ 3400 ?

8. Mr. Wise puts away 250 tons of hay in the fall. How many tons will the hay weigh in the spring if its loss in weight is 3 % of the weight in the fall ?

9. In a school of 960 pupils $2\frac{1}{2}$ % are absent. How many pupils are present ?

10. In a test 20 spelling words were given. Make out a table showing the per cent a pupil should receive who had spelled 20 words, 19 words, etc.

Words given . . .	20	20	20	20	20	20	20	20	20	20	20
Spelled correctly . .	20	19	18	17	16	15	14	13	12	11	10
Per cent											

Interest

Preparatory Exercises

1. Mrs. Priedigkeit has $200 in the savings bank. The bank pays her 4 % of this sum each year for the use of the money. How much does the bank give her yearly?

2. Mr. Beck buys a house for $3000. As he has only $2500 in cash, he borrows $500 from a bank, paying the bank 5 % yearly for the use of the money. How much per year must he pay the bank for the use of the money?

Money paid for the use of money is called **interest.**

---

3. Mr. Wendell buys a $100 machine on credit, agreeing to pay $100 at the end of the year with 6 % interest. How much does he pay at the end of the year including the interest?

Sight Exercises

1. Find the interest for 1 year on :

a. $200 at 5 %   *b.* $800 at 4 %   *c.* $900 at 6 %
d. $400 at 6 %   *e.* $300 at 5 %   *f.* $500 at 7 %

2. Find the interest at 5 % on:

a. $200 for 2 yr.   *b.* $150 for 2 yr.   *c.* $800 for ½ yr.
d. $400 for 1 yr.   *e.* $240 for 5 yr.   *f.* $400 for ¼ yr.

3. Find the interest at 6 % on :

a. $200 for 1 mo.   *b.* $100 for 4 mo.   *c.* $200 for 7 mo.

NOTE. — In calculating interest consider the year to consist of 12 months of 30 days each.

4. Find the interest at 4 % on :

a. $60 for 30 da.   *b.* $50 for 90 da.   *c.* $40 for 180 da.

Fractions of a Dollar — Multiplication

Written Exercises

1. What would be the cost of 860 bushels of potatoes at $62\frac{1}{2}$ cents per bushel?

<table>
<tr><td colspan="2" align="center">PROCESS</td></tr>
<tr>
<td>
215
$\dfrac{\cancel{860}}{1} \times \dfrac{\$5}{\cancel{8}} = \dfrac{\$1075}{2} = \$537.50.$ <i>Ans.</i>
</td>
<td>
Change $62\frac{1}{2}$ ¢ to $\$\frac{5}{8}$.
Multiply the latter by
860.   Cancel.   Write
the answer in dollars
and cents.
</td>
</tr>
</table>

2. Find the cost of articles as follows :

a. 464 lb. at $37\frac{1}{2}$¢   *b.* 253 bu. at 75¢   *c.* 184 gal. at $62\frac{1}{2}$¢

3. I bought 486 bushels of timothy seed at $\$2.37\frac{1}{2}$ per bushel. What was the amount of the bill?

<table>
<tr><td colspan="2" align="center">PROCESS</td></tr>
<tr>
<td>
486
$\$2\frac{3}{8}$
8)1458
$182\frac{1}{4}$
972
$\$1154.25.$ <i>Ans.</i>
</td>
<td>
Change $\$2.37\frac{1}{2}$ to $\$2\frac{3}{8}$ and use it as the
multiplier. Multiply 486 by $\frac{3}{8}$ by multiplying 486 by 3 and dividing the product
by 8. Change $\frac{1}{2}$ in the result to $\frac{1}{4}$. Multiply 486 by 2. Combine the partial products, changing $\$\frac{1}{4}$ to $\$.25$.
</td>
</tr>
</table>

4. Multiply (*a*) $\$2.37\frac{1}{2}$ by 28.   (*b*) $\$3.75$ by 34.   (*c*) $\$4.12\frac{1}{2}$ by 18.

Sight Exercises

1. Multiply by 48 :

(*a*) $12\frac{1}{2}$¢   (*b*) $87\frac{1}{2}$¢   (*c*) $37\frac{1}{2}$¢   (*d*) $62\frac{1}{2}$¢

2. Give the cost of the following items :

a. 88 at $\$1.12\frac{1}{2}$ *b.* 44 at $\$1.25$ *c.* 16 at $\$1.62\frac{1}{2}$

d. 24 at $\$1.16\frac{2}{3}$ *e.* 44 at $\$1.50$ *f.* 18 at $\$1.33\frac{1}{3}$

Division

Preparatory Exercises

1. At 3 quarter dollars each, how many dolls can be bought (*a*) for six quarter dollars? (*b*) For 9 quarter dollars? (*c*) For $2¼? (*d*) For $3?

2. Change each of the following to fourths and divide by 3 fourths :

(*a*) ¼　(*b*) ½　(*c*) 1　(*d*) 1¼　(*e*) 1½　(*f*) 2　(*g*) 2¼　(*h*) 3

3. At 75 cents each, how many baseballs can be bought for (*a*) $1.50? (*b*) $2.25? (*c*) $6?

Written Exercises

1. How many yards can be bought for $100 (*a*) at 75 cents per yard? (*b*) At 37½ cents per yard?

PROCESS

a. $100 ÷ 75¢ = $100 ÷ $¾ = 100 × $\frac{4}{3}$ = $\frac{400}{3}$ = 133⅓ (yd.).
　　　　　　　　　　　　　　　　　　　　Ans.

b. $100 ÷ 37½¢ = $100 ÷ $⅜ = 100 × $\frac{8}{3}$ = $\frac{800}{3}$ = 266⅔ (yd.).
　　　　　　　　　　　　　　　　　　　　Ans.

NOTE. — When the divisor and the dividend are of the same denomination, the sign of the latter may be dropped : $100 ÷ $¾ = 100 × ¾ ; 75 eighths ÷ 3 eighths = 75 ÷ 3.

2. Divide :

a. $42 by 37½¢　　*b.* $75 by 62½¢　　*c.* $84 by 75¢
d. $91 by 87½¢　　*e.* $57 by 12½¢　　*f.* $99 by 25¢

3. My bill for cloth at $1.87½ per yard came to $71.25 ; (*a*) how many yards did I buy? (*b*) How many bushels of timothy seed at $2.37½ a bushel would pay the bill?

PROCESS

$$a.\ \$71\tfrac{1}{4} \div \$1\tfrac{7}{8} = 2\tfrac{8}{4}\tfrac{5}{} \div 1\tfrac{5}{8} = \frac{\overset{19}{\cancel{285}}}{\cancel{4}} \times \frac{\overset{2}{\cancel{8}}}{\cancel{15}} = 38 \text{ (yd.)}.\ \textit{Ans.}$$

$$b.\ \$71\tfrac{1}{4} \div \$2\tfrac{3}{8} = 2\tfrac{8}{4}\tfrac{5}{} \div 1\tfrac{9}{8} = \frac{\overset{15}{\cancel{285}}}{\cancel{4}} \times \frac{\overset{2}{\cancel{8}}}{\cancel{19}} = 30 \text{ (bu.)}.\ \textit{Ans.}$$

4. Divide :

a. $112.50 by 1.87\tfrac{1}{2}$ b. $103.50 by $2.25

c. $141.75 by 3.37\tfrac{1}{2}$ d. $272.25 by 4.12\tfrac{1}{2}$

e. $127.50 by $3.75   f. $110.25 by 2.62\tfrac{1}{2}$

Sight Exercises

1. Give answers :

a. 9 eighths)27 eighths   b. 11 eighths)99 eighths

c. 3 halves)9 halves

2. Divide :

a. $\tfrac{54}{8} \div \tfrac{9}{8}$;   b. $\tfrac{44}{8} \div \tfrac{11}{8}$;   c. $\tfrac{78}{8} \div \tfrac{13}{8}$;   d. $\tfrac{60}{8} \div \tfrac{15}{8}$.

3. Give quotients. Change the divisor and the dividend to 8ths, and disregard the equal denominators.

a. 12.37\tfrac{1}{2}$ ÷ 1.12\tfrac{1}{2}$ b. 12.37\tfrac{1}{2}$ ÷ 1.37\tfrac{1}{2}$

c. 11.37\tfrac{1}{2}$ ÷ 1.62\tfrac{1}{2}$ d. $11.25 ÷ 1.87\tfrac{1}{2}$

4. Divide :

a. $11.25 by $1.25   b. $12.25 ÷ $1.75   c. $20.25 ÷ $2.25

5. How many yards of cloth can be bought for $21 when the price is (a) 1.16\tfrac{2}{3}$ per yard ? (b) 2.33\tfrac{1}{3}$? (c) $1.75? (d) $1.50 ?

Decimals

The denomination of a decimal is indicated by the number of decimal orders. A decimal of one order is read as *tenths;* of two orders, as *hundredths;* of three orders, as *thousandths;* of four orders, as *ten-thousandths*, etc. ; as is shown in the following table :

Thousands	Hundreds	Tens	Ones	Decimal Point	Tenths	Hundredths	Thousandths	Ten-thousandths	Hundred-thousandths
1	2	3	4	.	5	6	7	8	9

Reading Decimals

To read a decimal, ignore the decimal point and read it as the numerator of a common fraction, giving the name of its lowest order as the denominator.

.5 is read 5 tenths.

.03 is read as 3 hundredths.

.001 is read as 1 thousandth.

.234 is read as 234 thousandths.

.0203 is read as 203 ten-thousandths.

.12345 is read as 12345 hundred-thousandths.

Do not read a cipher or ciphers immediately following the decimal point; their presence being shown by the given denomination. Thus read .3, .03, .003, etc., *three* tenths, *three* hundredths, *three* thousandths, etc.

In reading mixed decimals, use the word "and" between the whole number and the decimal, omitting it in stating both the whole number and the decimal.

Thus, read 123.123, one hundred twenty-three *and* one hundred twenty-three thousandths.

Writing Decimals

To write a decimal, write the given number, then prefix as many decimal ciphers as are required to make the right-hand figure of the necessary order, the whole being preceded by the decimal point.

Thus, in writing 27 hundred-thousandths, first write 27, then three decimal ciphers to locate 7, the right-hand figure, in the fifth decimal place, .00027.

The value of a decimal is not changed by annexing or suppressing ciphers at the right of the decimal.

Since $\frac{300}{1000} = \frac{30}{100} = \frac{3}{10}$, .300 = .30 = .3.

Sight Exercises

Read the following:

a.	7.5	b.	3.075	c.	123.0467
d.	4.003	e.	.125	f.	.875
g.	.004	h.	22.0008	i.	29.00009
j.	1.2345	k.	.12345	l.	12.345
m.	.0625	n.	4.1875	o.	.0056
p.	.22	q.	.085	r.	.16

In dictating numbers containing decimals to a person who is writing them in columns, for instance, announce the decimal when it is reached. Thus, read (*a*) 7, "point," 5; (*d*) 4, "point," O, O, 3; (*g*) "point," O, O, 4; using the letter " O " to indicate a cipher. In reading such a number as 100.007, it is of special importance to announce the decimal point to prevent the possibility of its being mistaken for 107 thousandths (.107).

Addition and Subtraction

Written Exercises

1. Add :

a. 123.45	*b.* 21.00001	*c.* 32.74	*d.* 5.086
6.087	16.54	195.	3.998
22.9406	314.8964	95.0075	101.3061
8.88	87.74	275.6	4.77235
204.0375	535.2	1.59	9.63
77.7	98.881	888.084	.0008
987.54	250.004	129.1235	27.5

e. 294.3817	*f.* 31.57842	*g.* 938.893	*h.* 113.46
46.206	130.5215	.07541	49.6097
1.66	.93084	158.13477	19.9
4.68431	175.21	46.0045	9.87
26.2	43.1509	1.29	.0086
.1567	.807	.3714	18.253
523.63089	6.54321	82.389	6.04

i. $42.0985 + 3.73 + 61.29078 + .0897 + 12.3071 + 5.556$

2. Add horizontally and vertically :

a. $35.246 + 24.8469 + 9.85 + .5136 = $?
b. $9.4895 + 47.235 + .578 + 6.33 = $?
c. $51.898 + 8.7931 + 50.0992 + .8874 = $?
d. $3.9078 + .867 + 6.91 + 25.121 = $?
e. $24.693 + 97.64 + .579 + 2.778 = $?
$? + ? + ? + ? = $?

3. Subtract :

a. 200.	*b.* 103.462	*c.* 530.045	*d.* 118.2
-20.08754	-59.005357	-75.0565	-59.064

e. 135.246	*f.* 874.612	*g.* 647.5	*h.* 317.06
-48.73593	$-.623789$	-98.24687	-78.3027

Multiplication of Decimals

Written Exercises

1. Multiply $\frac{3}{10}$ by $\frac{3}{100}$. How many ciphers are there in the denominator of the product? Write $\frac{9}{1000}$ as a decimal. What is the product of .3 by .03?

2. Find the quantity of sheet steel in a strip 1.3 feet long, .07 feet wide.

```
                    PROCESS
1.3 (ft.)
                The product of 13 tenths by 7 hundredths
.07 (ft.)       is 91 thousandths, which contains 3 decimal
.091 (sq. ft.)  places. Prefix a decimal cipher.
```

3. Multiply:

a. 8.94 × .69	*b.* 9.752 × 1.7	*c.* 4.36 × .023
d. 36.37 × 9.5	*e.* 65.73 × .37	*f.* .657 × .034

4. Find the area of a strip of land 1.05 mi. long, .026 mi. wide.

```
                        PROCESS
      1.05 (mi.)
      .026 (mi.)         Prefix a decimal cipher to make the
                     necessary five places in the product,
         630         then reject the terminal cipher.
                         Thus, the product of 1 and 5 hun-
         210         dredths by 26 thousandths is 2730
      .02730         hundred-thousandths, which is reduc-
Ans. .0273 (sq. mi.) ible to 273 ten-thousandths.
```

5. Multiply:

a. 6.5 × 2.834	*b.* .315 × .26	*c.* 84.25 × 7.04
d. 8.432 × 4.25	*e.* 17.835 × .72	*f.* 484.48 × .025

Division of Decimals
Integral Divisors

Sight Exercises

Divide:

a. 2).04	*b.* 5).10	*c.* 8).40	*d.* 11).66
e. 3).006	*f.* 6).18	*g.* 9).045	*h.* 12).60
i. 4).0088	*j.* 7).021	*k.* 10).1230	*l.* 13).039
m. 2)8.04	*n.* 5)10.1	*o.* 8)8.4	*p.* 11)22.66

Written Exercises

1. A train traveled 21.68 miles in 32 minutes. What decimal of a mile did it travel per minute?

PROCESS

Ans. .6 etc. (mi.)
32)21.68 mi.
19 2
2 48
etc.

PROCESS

Write the decimal point in the quotient above the decimal point in the dividend. Continue the division by bringing down ciphers, but do not write them in the dividend.

Complete the work.

---

2. Complete the following:

a.   .08 etc.
25)2.14
2 00
140

b.   .005 etc.
25).146
125
210

3. Find quotients:

a. .292 ÷ 25	*b.* 2.92 ÷ 125	*c.* 324 ÷ 32
d. .192 ÷ 16	*e.* .72 ÷ 48	*f.* 24 ÷ 64
g. 2.92 ÷ 5	*h.* 3.6 ÷ 75	*i.* 36 ÷ 1875

Divisors ending in Ciphers

Written Exercises

1. Divide (*a*) 12 by 80. (*b*) 7.2 by 600. (*c*) 3 by 5000.

PROCESS

(*a*) 8∅)1.2/   (*b*) 6∅∅).07/2   (*c*) 5∅∅∅).003/
      .15   .012   .0006

Cancel the final cipher or ciphers in the divisor, and move the decimal point in the dividend as many places to the left as there are canceled ciphers in the divisor.

Divide the dividend as changed by the remaining figures of the divisor.

---

2. Divide :

a. 163.53 ÷ 900   *b.* 914.8 ÷ 1600   *c.* 90.09 ÷ 180
d. 19.591 ÷ 260   *e.* 278.35 ÷ 5000   *f.* 17.1 ÷ 240
g. 131.78 ÷ 400   *h.* 1.1256 ÷ 4200   *i.* 3.89 ÷ 250

Decimal Divisors

Preparatory Exercises

1. What are (*a*) 4 times 2 pounds? (*b*) 4 times $3?
(*c*) 4 times 2 tenths? (*d*) 4 times .2?

2. How many times are (*a*) 2 pounds contained in 8 pounds? (*b*) $2 in $8? (*c*) 2 thirds in 8 thirds?
(*d*) 2 tenths in 8 tenths? (*e*) .2 in .8?

3. Give quotients :

a. 2 lb.)8 lb.   *b.* $2)$8   *c.* $\frac{2}{3}$)$\frac{8}{3}$ *d.* .2).8

4. At 2 cents each, how many tops can be bought (*a*) for 50 cents? (*b*) for $1? (*c*) for $1.50? (*d*) for $2?

> *In dividing by a decimal change the divisor to a whole number by removing the decimal point, and make a corresponding change in the dividend.*

Divide (*a*) .4048 by 6.4.   (*b*) 91.08 by .24   (*c*) 1819.98 by .036.

PROCESS

(*a*) 6.4).4048   (*b*) .24)91.08   (*c*) .036)1819.98

    .06325 *Ans.*   379.5 *Ans.*   50555 *Ans.*

64)4.048   24)9108.   36)1819980.
  3.84   72   180
   208   190   199
   192   168   180
   160   228   198
   128   216   180
   320   120   180
   320   120   180

In (*a*) change the divisor to a whole number by moving the decimal point one place to the right, and make a similar change in the dividend.   In (*b*) move the decimal point two places to the right in both.   In (*c*) move the decimal point three places to the right, which requires the annexation of a cipher to the dividend.

The changed divisors and dividends may be rewritten as shown above.   The decimal point in the quotient is written over the decimal point in the changed dividend.

In (*a*) the divisor and the dividend are multiplied by 10, in (*b*) by 100, and in (*c*) by 1000.

> *The quotient is unchanged when the divisor and the dividend are multiplied or divided by the same number.*

Written Exercises

1. Divide :

a. 23.541 ÷ .6	*b.* 637.94 ÷ .08	*c.* .18018 ÷ .007
d. 3.7598 ÷ .4	*e.* 767.94 ÷ 1.2	*f.* .43043 ÷ 1.1
g. 5.2317 ÷ .09	*h.* 831.74 ÷ .5	*i.* 1.8936 ÷ .24

2. Divide (*a*) 18.3 by .028   (*b*) 1.83 by .27.

PROCESS

Ans.   653.571⁺

/028)18/300.

    168
    ‾‾‾
    150

    140
    ‾‾‾
    100

     84
    ‾‾‾
    160

    140
    ‾‾‾
    200

    196
    ‾‾‾
     40

     28
    ‾‾‾
     12

6.77.   *Ans.* 6.7̇

/27)1/83.

   162
   ‾‾‾
   210

   189
   ‾‾‾
   210

In (*a*) the plus sign after the last quotient figure shows that there is a remainder and that the next quotient figure is less than 5. In (*b*) each partial remainder after the first is 21, which produces successive quotient figures of 7, 7, 7, etc. This is indicated by a period written over the first 7, as shown above. The answer may also be written 6.778⁻, the last quotient figure being increased by 1 and a minus sign written after it, which means that it is greater than 6.775, and less than 6.778.

In the following examples, give only three significant figures after the decimal point; that is, three figures other than ciphers. When the fourth figure is 5 or more, increase the preceding figure by 1 and write a minus sign after it; when the fourth figure is less than 5, place a plus sign after the third figure.

3. Find quotients :

a. 124.054 ÷ 23.785	*b.* 2.3452 ÷ 245.31
c. 11.224 ÷ 2.576	*d.* 83.423 ÷ 31.586

Reductions — Decimals to Common Fractions

Written Exercises

1. Change to common fractions (*a*) .051; (*b*) .64; (*c*) .0075.

PROCESS

a. $.051 = \frac{51}{1000}$. *Ans.*   *b.* $.64 = \frac{64}{100} = \frac{16}{25}$. *Ans.*

c. $.0075 = \frac{75}{10000} = \frac{3}{400}$. *Ans.*

Rewrite each decimal in the form of a common fraction. Since in (*a*) the numerator ends in an odd number other other than 5, it is expressed in lowest terms. In (*b*) divide both terms by 4; in (*c*) by 25.

2. Express as common fractions in lowest terms :

a. .004	*b.* .125	*c.* .375	*d.* .0375
e. .0004	*f.* .0625	*g.* .242	*h.* .048
i. .1875	*j.* .085	*k.* .0056	*l.* .036
m. .1648	*n.* .0256	*o.* .96	*p.* .096

Common Fractions to Decimals

Since the fraction $\frac{3}{4}$ indicates that 3 is divided by 4, it is changed to a decimal by performing the division:

4)3.00   Dividing 300 hundredths by 4 gives a quotient
 .75 *Ans.*   of 75 hundredths.

To change $\frac{5}{8}$ to a decimal, the dividend is made 5000 thousandths, which gives a quotient of   8)5.000
625 thousandths.   .625 *Ans.*

In practice, omit the ciphers. Place a decimal point after the last figure of the numerator, and one in the quotient when it is reached in the dividend, prefixing decimal ciphers in the quotient when required.

Written Exercises

1. Change (a) $\frac{3}{16}$; (b) $\frac{7}{80}$ to decimals.

a. 16)3.
　.1875. *Ans.*

b. 80).7/
　.0875. *Ans.*

2. Change to decimals:

a. $\frac{1}{16}$　　b. $\frac{1}{125}$　　c. $\frac{9}{64}$　　d. $\frac{3}{80}$　　e. $\frac{81}{125}$

f. $\frac{5}{16}$　　g. $\frac{3}{125}$　　h. $\frac{1}{32}$　　i. $\frac{11}{80}$　　j. $\frac{17}{250}$

Sight Exercises

Change to common fractions:

a. .24　　b. .375　　c. .075　　d. .15　　e. .05

f. .6　　g. .625　　h. .84　　i. .045　　j. .005

Compound Fractions and Complex Fractions

An expression consisting of a fraction of a fraction is called a *compound fraction;* such as

$$\tfrac{3}{4} \text{ of } \tfrac{9}{10}, \ \tfrac{7}{8} \text{ of } 3\tfrac{3}{4}, \text{ etc.,}$$

A fractional expression containing a fraction in the numerator, or in the denominator, or in both, is called a *complex fraction;* such as

$$\frac{2\tfrac{1}{2}}{3}, \ \frac{4}{3\tfrac{7}{8}}, \ \frac{5\tfrac{1}{2}}{6\tfrac{2}{3}}, \text{ etc.}$$

To simplify a compound or a complex fraction perform the indicated operation.

Sight Exercises

1. Simplify the following:

a. $\frac{2}{3}$ of $\frac{9}{16}$　　　　b. $\frac{3}{4}$ of $1\frac{1}{3}$　　　　c. $\frac{4}{7}$ of $3\frac{1}{2}$

d. $\frac{3}{7}$ of $\frac{5}{12}$　　　　e. $\frac{2}{5}$ of $3\frac{3}{4}$　　　　f. $\frac{5}{6}$ of $1\frac{1}{5}$

Reducing Complex Decimals

To change a complex decimal, write it as a complex fraction, and simplify the latter.

Written Exercises

1. Change (*a*) .8⅓ ; (*b*) .46⅔ to common fractions.

PROCESS

$$(a) \quad .8\tfrac{1}{3} = \frac{8\tfrac{1}{3}}{10} = \frac{\overset{5}{\cancel{25}}}{3} \times \frac{1}{\underset{2}{\cancel{10}}} = \frac{5}{6}. \quad Ans.$$

$$(b) \quad .46\tfrac{2}{3} = \frac{46\tfrac{2}{3}}{100} = \frac{\overset{7}{\cancel{140}}}{3} \times \frac{1}{\underset{5}{\cancel{100}}} = \frac{7}{15}. \quad Ans.$$

---

2. Reduce to common fractions, lowest terms :

a. .3⅓	*b.* .83⅓	*c.* .642⅖	*d.* .23 1/13
e. .2⅖	*f.* .57⅐	*g.* .812½	*h.* .91⅔

Decimal Drills

Change a decimal multiplier or divisor to a common fraction, when it will simplify the work.

1. Give products :

a. 60 × .3	*b.* .25 × 48	*c.* 24 × .125	*d.* 125 × .24
e. 25 × .4	*f.* .75 × 36	*g.* 48 × .375	*h.* 375 × .48
i. 48 × .5	*j.* .12 × 25	*k.* 32 × .625	*l.* 625 × .64

2. Give quotients :

a. 36 ÷ .3	*b.* 42 ÷ .25	*c.* 21 ÷ .125	*d.* 21 ÷ 1.25
e. 24 ÷ .4	*f.* 24 ÷ .75	*g.* 24 ÷ .375	*h.* 24 ÷ 3.75
i. 32 ÷ .5	*j.* 36 ÷ .12	*k.* 35 ÷ .625	*l.* 35 ÷ 6.25

Sight Problems

1. If a drover sells 24 cattle of his herd of 64, (*a*) what fraction of the herd does he sell? (*b*) What decimal of the herd? (*c*) How many hundredths?

2. John is 12 years old, James is 16 years old. (*a*) John's age is what decimal of James's? (*b*) James's age is what fraction of John's?

3. If I buy a horse for $160 and sell it for $200, (*a*) what decimal of the cost is the profit? (*b*) What fraction of the selling price is the profit?

4. A kilogram is a weight of 2.2046 pounds. How many pounds are there in 1000 kilograms?

5. A kilometer is 1000 meters of 39.37 inches each; how many inches are there in a kilometer?

6. Find the cost of an acre of land at the rate of $40 for .2 acre.

7. The owner of a flock of 120 sheep sold 90 of them. (*a*) What fraction of the flock did he sell? (*b*) What decimal?

8. If a man spends .67 of his money, what decimal of it has he left?

9. After spending .67 of his money a boy has 66 cents left; how much money had he at first?

10. If I buy a cow for $40 and sell it for $50, my profit is what decimal (*a*) of the cost of the cow? (*b*) Of the price received for it?

11. (*a*) What fraction of 25 is 15? (*b*) What decimal of 25 is 15? (*c*) What fraction of 15 is 25? (*d*) How many hundredths of 25 is 15?

12. If 15 hundredths of a number is 60, what is the number?

Written Problems

1. Mr. Ullo has three farms, the first containing 240.8125 acres, the second containing 37.5 acres more than the first, and the third containing 65.44 acres more than the second. How many acres are there (*a*) in the second farm? (*b*) In the third? (*c*) In the three farms?

2. At 62.5 bushels to the acre, how many bushels of corn will be raised on 324 acres?

3. The perimeter of a square field is 326.4 rods. Find the area (*a*) in square rods; (*b*) in acres, at 160 square rods to the acre.

4. How many bales of 93.75 pounds each will weigh 5.4375 tons?

5. (*a*) Find in cubic yards the capacity of a bin 18.75 ft. long, 13.5 ft. wide, 11.2 ft. deep. (*b*) How many bushels of grain would it hold at .8 bu. to the cubic foot?

6. A train goes 851 miles in 18.4 hours. (*a*) How many miles per hour is its average rate? (*b*) How long would it require to go 1110 miles at the same speed?

7. From a plot 60.625 rods long and 53.5 rods wide a piece is sold 24.25 rods long and 21.4 rods wide. What decimal part of the original piece (*a*) is sold? (*b*) Is left?

8. If .75 of M's farm contains 94.35 acres, how many acres are there in the farm?

9. The total length of three sections of a railroad is 100 miles; one section is 43.65 miles long, another is 22.375 miles long; how long is the third section?

10. How much is the cost of an acre of land at the rate of $29 for .125 acre?

11. After withdrawing from bank 67 hundredths of his money a man has still in bank $132. How many dollars had he originally in the bank?

Areas of Right Triangles

Preparatory Exercises

1. How many square yards are there in a rectangle 48 yards long, 25 yards wide?

2. When the foregoing rectangle is divided into two equal parts by a line extending from one corner to an opposite one, how many square yards are there in each part?

3. When the sides of a rectangular sheet of iron measure 10 and 12 inches, respectively, (*a*) how many square inches does it contain? (*b*) What is the area of each of the two triangles into which it is divided by the diagonal?

4. What is the area of each piece of ground into which a rectangular plot 30 inches by 20 inches is divided by a diagonal?

A figure of four sides is called a *quadrilateral*. When a quadrilateral has four square corners, it is called a *rectangle*. When the sides of a rectangle are equal it is called a *square*.
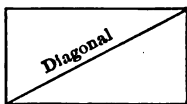
A line extending from one corner of a quadrilateral to the opposite corner is called a *diagonal*. The diagonal of a rectangle divides the latter into two triangles, called *right triangles*, each containing a square corner.

The side of a right triangle corresponding to the diagonal of the rectangle, is the longest; it is called the *hypotenuse*. One of the other sides is called the *base*, and the remaining side is called the *perpendicular;* these two sides correspond with the length and the width of a rectangle, and are called the *dimensions* of the triangle.
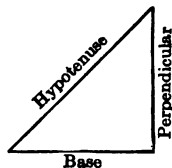
Written Exercises

1. Find the number of square yards in a piece of ground in the form of a right triangle when its base measures 21 yd. 1 ft. and its perpendicular 16 yd. 1 ft. 6 in.

PROCESS

$$\tfrac{1}{2} \text{ of } 21\tfrac{1}{3} \text{ (yd.)} \times 16\tfrac{1}{2} \text{ (yd.)} = \frac{1}{\cancel{2}} \times \frac{\cancel{64}}{\cancel{3}} \times \frac{\cancel{33}}{\cancel{2}} = 176 \text{(sq. yd.).}$$
Ans.

Write each dimension as yards and a fraction. Change each mixed number to an improper fraction. Indicate the continued product of $\tfrac{1}{2}$ and the two improper fractions. Cancel.

---

2. How many square feet are there in a right triangle whose dimensions are 18 ft. 9 in. and 13 ft. 4 in.?

Number of square feet = $\tfrac{1}{2}$ of $18\tfrac{3}{4} \times 13\tfrac{1}{3}$.
Change to improper fractions and cancel.

3. Find the number of acres in a rectangular field 62.5 rods long, 38.4 rods wide.

As there is no linear measure corresponding to the acre, the area in square rods is divided by 160.

Area in acres = $\dfrac{62.5 \times 38.4}{160}$.   Cancel.

4. How many square rods are there in a right triangle having a base of 33 yards and a perpendicular of 36 yards 2 feet?

5. Find the area in acres and the perimeter in rods of a right triangle whose base measures 45 rods and whose perpendicular measures 24 rods, the hypotenuse measuring 51 rods. What fraction of a mile is the perimeter?

Rectangular Solids

A *rectangular prism* is a solid having six rectangular faces. When all the faces are square, the solid is called a *cube*. When the ends are square and the four remaining faces are rectangles, the solid is called a *square prism*.
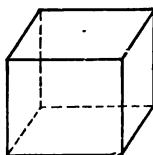
A *surface* has two dimensions, length and breadth ; a *solid* has three : length, breadth, and thickness.

Volume of Rectangular Solids

The volume of a rectangular prism is the continued product of the length by the breadth by the thickness.

Sight Problems

1. Find the volume of a rectangular block of granite 3 ft. high, 4 ft. long, 2 ft. 6 in. wide.

Number of cubic feet = $3 \times 4 \times 2\frac{1}{2}$

2. Find the surface of the outside of a box having

    a. 2 faces, each 3 ft. by 4 ft.
    b. 2 faces, each 4 ft. by 2 ft. 6 in.
    c. 2 faces, each 3 ft. by 2 ft. 6 in.

3. How many cubic feet are there in a pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high ?

4. At $7\frac{1}{2}$ gallons to the cubic foot, how many gallons would a tank hold whose dimensions are 2 ft. $\times$ 2 ft. $\times$ 2 ft. ?

Written Problems

1. At 231 cu. in. to the gallon, how many gallons are there ·in a cubic foot ? (*a*) Give the answer as a mixed decimal. (*b*) As a mixed number, expressing the fraction in lowest terms.

2. At 7½ gallons to the cubic foot, find the capacity in gallons of a tank 11 ft. long, 3 ft. wide, 7 ft. high.

3. At 231 cubic inches to the gallon, how many gallons will a tank contain whose dimensions are 11 ft. by 3 ft. by 7 ft. ?

Indicate the number of inches in each dimension and divide by 231.

Cancel. $\dfrac{11 \times 12 \times 3 \times 12 \times 7 \times 12}{231}$.

4. A bushel contains 2150.4 cu. in. How many cubic feet are there in a bushel ? Find answer (*a*) as a mixed decimal (three places). (*b*) As a mixed number.

5. Change $\frac{4224}{17280}$ to lowest terms.

6. At 1¼ cubic feet to the bushel, what decimal of a bushel is a cubic foot ?

7. Find the capacity in bushels of a bin 8 ft. 3 in. by 4 ft. 8 in. by 3 ft. 9 in., at ⅘ bu. to the cu. ft.

8. · At ⅘ bushel to the cubic foot, find the number of bushels of grain in a bin 2⅔ feet square, the depth of the grain being 1¾ feet.

$$2\tfrac{2}{3} \times 2\tfrac{2}{3} \times 1\tfrac{3}{4} \times \tfrac{4}{5}\ \text{bu.}$$

Observe that 1 cubic foot is nearly 7½ gallons and nearly ⅘ bushel.

9. A farmer built a silo 15 feet square, inside measurement, and 30 feet high. (*a*) Find its capacity in cubic feet. (*b*) At 50 lb. to the cubic foot, how many tons of feed will it hold ?

10. At $6 per cubic foot, what is the cost of a granite column 18 inches square and 9 feet high?

Make rough diagrams when necessary.

11. Find the number of square yards in the area of a right triangle having a base of 13 yd. 1 ft. and a perpendicular of 19 yd. 1 ft. 6 in.

12. A field in the form of a right triangle contains an acre. If the perpendicular is 24 rods, what is the base?

13. A room is 18 ft. long, 15 ft. wide, and 9 ft. high. How many square yards of surface are there in the walls and the ceiling?

14. The rug on a parlor floor 18 ft. by 15 ft. leaves uncovered a strip 1½ ft. wide around the sides of the room. (*a*) What are the dimensions of the rug? (*b*) How many square yards does it contain? (*c*) How many square yards are there in the uncovered portion of the floor? (Make a diagram.)

15. How many square yards of carpet are there in a roll 36 yards long, 27 inches wide?

16. How many square yards are there in a strip of grass 30 yards long, 2 feet wide?

17. If a field is 10 yards wide, how many times would a person go back and forth in cutting the grass with a machine that cuts a strip 2 feet wide?

18. How many strips of carpet 27 inches wide will cover a floor 9 yards wide? (Diagram.)

19. (*a*) How many square feet are there in a lawn 20 yards long, 10 yards wide? (*b*) If the steps taken in turning are not counted, how many feet does a boy walk in cutting the grass with a lawn-mower that cuts a strip 2 feet wide?

20. How many cords of wood are there in a pile 16 feet long, 4 feet wide, and 8 feet high?

Reviews — Addition and Subtraction

Oral Drills

To add 647 and 24, think 667 (6 × 7 + 20), 671 (adding 4).

1. Add. Give sums:

a. 247 + 48	*b.* 128 + 126	*c.* 845 + 260	*d.* 55 + 135
e. 364 + 29	*f.* 115 + 158	*g.* 728 + 361	*h.* 44 + 149
i. 438 + 37	*j.* 154 + 119	*k.* 633 + 148	*l.* 33 + 127
m. 527 + 53	*n.* 139 + 137	*o.* 554 + 219	*p.* 22 + 118

To diminish 384 by 36, think 354(384 − 30), 348(− 6).

2. Give remainders:

a. 195 − 18	*b.* 153 − 119	*c.* 930 − 160	*d.* 592 − 68
e. 283 − 27	*f.* 241 − 227	*g.* 844 − 180	*h.* 483 − 59
i. 374 − 36	*j.* 362 − 338	*k.* 768 − 190	*l.* 371 − 47
m. 461 − 44	*n.* 476 − 418	*o.* 651 − 170	*p.* 264 − 36

Sight Problems

1. What is the profit on furniture bought for $148 and sold for $175?

2. If a man has 143 acres of land, how much will he have after buying 47 acres more?

3. A boy picked 119 quarts of strawberries and his sister picked 79 quarts. How many quarts did both pick?

4. A dealer sold 128 tons of coal on Monday and 68 tons on Tuesday. How many tons did he sell in the two days?

5. What did Mr. Jones pay for a lot if he lost $49 by selling it for $126?

6. A man's earnings are $150 per month. He spends $116. How much does he save?

Written Exercises

1. A farmer sold five loads of apples at 90 cents per bushel of 50 pounds. Fill out the following

STATEMENT

GROSS WEIGHT	WEIGHT OF WAGON	NET WEIGHT	BUSHELS	PRICE	VALUE
3380	1230	2150	43	$.90	$38.70
3425	1225				
3417	1267				
3448	1198				
3319	1219				
Totals (a)	(b)	(c)	(d)	$.90	(e)

2. Mr. Brown's receipts from sales of produce during 1914 and 1915, respectively, are given in the following table:

PRODUCE	SALES, 1914	SALES, 1915	INCREASE, 1915 OVER 1914	DECREASE, 1915 FROM 1914
Grain . . .	$1876.50	$2134.91	(c)	
Vegetables .	347.22	298.74		(d)
Poultry . .	96.45	134.80	(c)	
Hay . . .	518.34	345.70		(d)
Eggs . . .	237.18	416.00	(c)	
Milk . . .	354.60	362.76	(c)	
Totals . .	(a)	(b)	(f)	

Copy the foregoing table and insert (*a*) the total sales for 1914, (*b*) the total sales for 1915, (*c*) the several increases in 1914, (*d*) the decreases, and (*f*) the net increase.

Adding Mixed Numbers

Written Exercises

1. A piece of work required the labor of four men for $3\frac{7}{15}$ days, $5\frac{9}{20}$ days, $2\frac{11}{18}$ days, and $1\frac{5}{8}$ days, respectively. How many days of labor were required?

LEAST COMMON MULTIPLE

$$2)15 - 20 - 18 - \cancel{9}$$
$$\underline{3)15 - 10 - \ \ 9}$$
$$\ \ \ \ \cancel{5} - 10 - \ \ 3$$
$$2 \times 3 \times 10 \times 3 = 180 \ (\text{L. C. M.})$$

After writing the denominators in a row cancel 9, which is a factor of 18. Divide the remaining numbers by 2 bringing down 15.

Divide the three quotients by 3 (the smallest factor of two of them) and bring down 10. Cancel 5, which is a factor of 10. Since 10 and 3 have no common factor, multiply together these two numbers and the two divisors, which gives 180 as the least common multiple of the denominators.

---

2. Find sums:

a. $\ \ 9\frac{3}{7}$	*b.* $16\frac{5}{6}$	*c.* $18\frac{5}{18}$	*d.* $33\frac{7}{8}$
$\ \ 15\frac{3}{8}$	$20\frac{3}{8}$	$4\frac{11}{16}$	$6\frac{7}{12}$
$\ \ \ 7\frac{5}{12}$	$8\frac{7}{20}$	$6\frac{3}{20}$	$40\frac{8}{15}$
e. $16\frac{3}{10}$	*f.* $\ \ 1\frac{4}{5}$	*g.* $\ \ 7\frac{3}{14}$	*h.* $22\frac{3}{10}$
$\ \ 5\frac{1}{9}$	$42\frac{7}{12}$	$8\frac{2}{3}$	$6\frac{2}{9}$
$\ \ 12\frac{3}{4}$	$3\frac{5}{6}$	$20\frac{1}{9}$	$17\frac{1}{6}$
$\ \ \ 8\frac{7}{12}$	$19\frac{2}{15}$	$4\frac{5}{6}$	$20\frac{5}{12}$
i. $25\frac{5}{7}$	*j.* $15\frac{1}{2}$	*k.* $\ \ 3\frac{1}{2}$	*l.* $14\frac{2}{3}$
$\ \ 6\frac{1}{8}$	$5\frac{2}{3}$	$14\frac{2}{3}$	$6\frac{2}{5}$
$\ \ 22\frac{1}{12}$	$30\frac{1}{4}$	$8\frac{2}{7}$	$18\frac{3}{14}$
$\ \ 3\frac{3}{14}$	$6\frac{1}{6}$	$9\frac{3}{10}$	$41\frac{2}{7}$
$\ \ 5\frac{5}{24}$	$28\frac{2}{7}$	$52\frac{1}{4}$	$8\frac{7}{15}$

Subtracting Mixed Numbers

3. Find remainders:

a. $25\frac{2}{7}$	*b.* $34\frac{2}{15}$	*c.* $42\frac{1}{2}$	*d.* $87\frac{3}{8}$
$-6\frac{5}{8}$	$-17\frac{5}{6}$	$-5\frac{7}{9}$	$-28\frac{1}{4}$
e. $73\frac{2}{3}$	*f.* $98\frac{1}{4}$	*g.* $65\frac{1}{6}$	*h.* $56\frac{2}{3}$
$-8\frac{7}{8}$	$-29\frac{2}{9}$	$-9\frac{3}{7}$	$-47\frac{5}{6}$

Multiplying Mixed Numbers

4. Write products directly from the book:

a. $86\frac{2}{3}$	*b.* $37\frac{2}{5}$	*c.* $64\frac{3}{4}$	*d.* $72\frac{1}{4}$
$\times 6$	$\times 5$	$\times 8$	$\times 9$
e. $95\frac{1}{2}$	*f.* $47\frac{2}{3}$	*g.* $25\frac{2}{6}$	*h.* $59\frac{4}{7}$
$\times 7$	$\times 4$	$\times 9$	$\times 3$

Dividing Mixed Numbers

5. Write quotients from the book:

a. $2\overline{)876\frac{2}{3}}$ *b.* $3\overline{)978\frac{3}{5}}$ *c.* $4\overline{)872\frac{1}{4}}$

d. $2\overline{)977\frac{1}{2}}$ *e.* $3\overline{)595\frac{1}{2}}$ *f.* $4\overline{)893\frac{1}{3}}$

g. $2\overline{)975\frac{1}{2}}$ *h.* $3\overline{)586\frac{1}{3}}$ *i.* $4\overline{)887\frac{1}{2}}$

6. Write answers:

a. $\frac{1}{2}$ of $984\frac{2}{3}$ *b.* $\frac{1}{3}$ of $969\frac{2}{3}$ *c.* $\frac{1}{4}$ of $960\frac{4}{5}$

d. $\frac{1}{3}$ of $673\frac{1}{2}$ *e.* $\frac{1}{5}$ of $672\frac{1}{2}$ *f.* $\frac{1}{8}$ of $963\frac{1}{2}$

g. $\frac{1}{4}$ of $845\frac{1}{3}$ *h.* $\frac{1}{6}$ of $488\frac{1}{2}$ *i.* $\frac{1}{9}$ of $994\frac{1}{2}$

Multiplying by 75, $37\frac{1}{2}$, $62\frac{1}{2}$, $87\frac{1}{2}$

Preparatory Exercises

1. How many hundred pounds will 64 hams weigh at (*a*) $\frac{1}{8}$ of 100 lb. each? (*b*) At $12\frac{1}{2}$ pounds each?

2. (*a*) How many bushels of wheat can be raised on 64 acres at the rate of $37\frac{1}{2}$ bushels to the acre? (*b*) How many bushels of oats at $62\frac{1}{2}$ bushels to the acre? (*c*) How many bushels of corn at $87\frac{1}{2}$ bushels to the acre?

Written Exercises

1. How many tons of rails will a mill turn out in 308 days at the rate of (*a*) $37\frac{1}{2}$ tons per day? (*b*) $62\frac{1}{2}$ tons per day? (*c*) $87\frac{1}{2}$ tons per day? (*d*) 75 tons per day?

ANALYSIS

(*a*) $37\frac{1}{2} \times 308 = \frac{300}{8} \times 308 = \frac{92400}{8} = 11550$ (T.) *Ans.*

(*b*) $62\frac{1}{2} \times 308 = \frac{500}{8} \times 308 = \frac{154000}{8} = 19250$ (T.) *Ans.*

Write the numbers as shown below, and without writing 300, 500, 800, etc., multiply 308 in (*a*) by 300, in (*b*) by 500, and in (*c*) by 700, and divide each product by 8. In (*d*) multiply 308 by 300 and divide the product by 4.

PROCESS

(*a*) $308 \times 37\frac{1}{2}$ T.   (*b*) $308 \times 62\frac{1}{2}$ T.

8)92400 T.   8)154000 T.

Ans. 11550 T.   *Ans.* 19250 T.

---

2. Multiply by $37\frac{1}{2}$. **3.** By $62\frac{1}{2}$. **4.** By $87\frac{1}{2}$. **5.** By 75.

(*a*) 136   (*b*) 257   (*c*) 334   (*d*) 467   (*e*) 592

(*f*) 677   (*g*) 734

Multiplying by 99, etc.

Written Exercises

1. What is the cost of 247 yards of silk (*a*) at 71¢ per yd.?   (*b*) At 69¢?

<table>
<tr><td colspan="3" align="center">PROCESS</td></tr>
<tr>
<td>(*a*)   247 × 71¢
    1729
$175.37 *Ans.*</td>
<td>(*b*)   247 × 69¢
    1729
$170.43</td>
<td>In (*b*) deduct the
product by 1 from the
product by 7 tens.</td>
</tr>
</table>

2. Find products:

a.	984 × 19	*b.*	49 × 624	*c.*	218 × 79
d.	876 × 29	*e.*	59 × 547	*f.*	179 × 89
g.	753 × 39	*h.*	69 × 432	*i.*	264 × 79

3. At $145 per acre, find the cost (*a*) of 99 acres of land.   (*b*) Of 999 acres.

<table>
<tr><td colspan="3" align="center">PROCESS</td></tr>
<tr>
<td>$145 × 99 .
 14500
$14355 *Ans.*</td>
<td>$145 × 999
145000
$144855</td>
<td>Deduct $145 in (*a*) from
100 times $145, in (*b*) from
1000 times $145.</td>
</tr>
</table>

4. Multiply by 99:

a. 234.   *b.* 345.   *c.* 456.   *d.* 567.   *e.* 678.

Sight Exercises

5. Give products:

a.	91 × 99	*b.*	80 × 29	*c.*	19 × 50	*d.*	99 × 87
e.	99 × 92	*f.*	90 × 39	*g.*	69 × 40	*h.*	76 × 99
i.	93 × 99	*j.*	70 × 49	*k.*	89 × 30	*l.*	99 × 65
m.	99 × 94	*n.*	60 × 59	*o.*	79 × 20	*p.*	54 × 99

Household Problems

1. Mr. Watson earns $30 per week. (*a*) What does he earn in 52 weeks? He spends 25 % of it in rent. (*b*) What is his monthly rent? The food for his family costs 30 % of his earnings. (*c*) What does it cost per week? His bills for gas, fuel, repairs, etc., average 10 % of his earnings. (*d*) What do they cost per month? He spends 20 % for clothing for his family. (*e*) What is the annual cost? (*f*) What is left for recreation, doctor's bills, insurance, charity, church dues, etc.?

2. Find the cost of each of the following meals, the cost for each day, and the total cost for the week, including in the latter 25 ¢ for the cost of lard, pepper, salt, etc.

The prices given cover cost for two adults and four children.

FIRST DAY

Breakfast		*Dinner*		*Supper*	
Cereal—milk—sugar	8 ¢	Baked macaroni and cheese	5½ ¢	French toast	4 ¢
Bread and butter	6½	Spinach	5½	Stewed apricots	9
Codfish	12	Stewed peaches	8	Cocoa—milk—sugar	9
Coffee—milk	6	Coffee—milk—sugar	6		

SECOND DAY

Breakfast		*Dinner*		*Supper*	
Cereal—milk—sugar	8 ¢	Ox-tail stew	15 ¢	Cheese on toast	6½ ¢
Eggs	16	Carrots	2	Escarole salad	11½
Bread and butter	6½	Bread and butter	6½	Apple sauce	6
Coffee—milk—sugar	6	Custard and bananas	16	Tea—milk—sugar	5

THIRD DAY

Breakfast		*Dinner*		*Supper*	
Cereal—milk—sugar	8 ¢	Flank steak	20 ¢	Milk toast	4 ¢
Biscuit—butter	10	Onions	5	Lettuce salad	11½
Eggs	16	Bread and butter	6½	Molasses cake	6
Coffee—milk—sugar	6	Lemon jelly	12	Cocoa—milk—sugar	9

FOURTH DAY

Breakfast		*Dinner*		*Supper*	
Corn bread—butter	10¢	Pot roast	18¢	Boston baked beans	10¢
Omelets	12	Macaroni	4	Bread and butter	6½
Coffee—milk—sugar	6	Bread and butter	6½	Cabbage salad	10
		Junket	8	Sliced oranges	5
		Coffee—milk—sugar	6	Tea—milk—sugar	5

FIFTH DAY

Breakfast		*Dinner*		*Supper*	
Corn bread—butter	10¢	Cold meat	18¢	Egg salad	18¢
Hashed potatoes	2	Rice and tomatoes	11	Bread and butter	6½
Coffee—milk—sugar	6	Apple pudding	16	Prunes	4
				Tea—milk—sugar	5

SIXTH DAY

Breakfast		*Dinner*		*Supper*	
Cereal—milk—sugar	8¢	Hash balls	12¢	Lentil soup	8¢
Bread and butter	6½	Peas	9	Biscuits—cheese	12
Scrambled eggs	16	Bread and butter	4½	Tea—milk—sugar	5
Coffee—milk—sugar	6	Custard	10		
		Coffee—milk—sugar	6		

SEVENTH DAY

Breakfast		*Dinner*		*Supper*	
Baked apple	8¢	Baked haddock	18¢	Fried hominy—sirup	5¢
Milk toast	8	Escalloped tomatoes	6	Apple sauce	6
Coffee—milk—sugar	6	Creamed potatoes	9	Cocoa—milk—sugar	9

5. Find the weekly cost of the following items of a United States Navy ration:

ALLOWANCE PER DAY

1¼ lb. meat	@ 12¢	¼ lb. coffee	@ 16¢
1¼ lb. potatoes	@ 1½¢	$\frac{1}{16}$ qt. milk	@ 8¢
1¼ lb. bread	@ 4¢	¼ lb. sugar	@ 6¢
$\frac{9}{16}$ lb. apples	@ 2¢	¼ lb. butter	@ 32¢

ALLOWANCE PER WEEK

¼ lb. macaroni	@ 6¢	$\frac{1}{32}$ lb. mustard	@ 48¢
¼ lb. cheese	@ 16¢	$\frac{1}{128}$ lb. spices	@ 16¢
¼ lb. tomatoes	@ 20¢	$\frac{1}{16}$ gal. vinegar	@ 16¢
¼ lb. salt	@ 1¢	$\frac{1}{32}$ gal. pickles	@ 16¢
$\frac{1}{32}$ lb. pepper	@ 16¢	$\frac{1}{32}$ gal. molasses	@ 24¢

Household Accounts

Although Mrs. Mullaly runs no bills except for milk, ice, and gas, she finds it possible to make better use of the money allotted to household expenses by keeping an account in the following form, using an ordinary memorandum book:

1914			EXPENSES	Dr.		Cr.	
Aug.	1		Cash on hand	48	42		
	8		Groceries (for week)			1	80
			Baker			1	05
			Milk, Butter, Eggs			2	56
			Vegetables				60
			Fruit				42
			Ice				35
			Cash rec'd	25	—		
			Balance			66	64
	10		Cash on hand	73	42	73	42
				66	64		
			Savings Bank			30	—

The foregoing entries are made weekly from slips received from the grocer, butcher, etc., at the time of each purchase. The weekly balance should agree with the cash on hand.

The account is balanced by adding the Dr. column, inserting the total (73.42) in this column and also in the Cr. column, then writing the sum (66.64) needed to make the total. As this is not an expenditure, it is written in red ink by bookkeepers. The account is reopened on August 10 by writing Cash on hand, with the amount ($66.64).

Written Exercises

1. Copy the foregoing account and extend it another week. Include one or more purchases of dry goods, etc. Balance the account Aug. 15, and reopen it Aug. 17.

2. Henry Schamell received a bill from Meissner and Brunkhurst for $187.50 for furniture purchased during September, 1914. He mails the following check in payment:

No. *473*

PORTLAND, OREGON, *Oct. 1*, 191 *4*

NATIONAL SCHOOL BANK

Pay to the order of   *Meissner and Brunkhurst*

~~*One Hundred Eighty-seven*~~ $\frac{50}{100}$ *Dollars*

(In school currency)

$*187* $\frac{50}{100}$ *Henry Schamell*

To obtain the money for the foregoing check Meissner and Brunkhurst must *indorse* it; that is, a member of the firm must write the firm's name on the back. When Mr. Schamell finally receives it from his bank, after it has been paid, he retains it as a receipt.

3. Make out a bill for groceries purchased at different times during a month. Try to make the quantities such as would be needed by a family of four adults.

4. Make out a check in the foregoing form for the groceries purchased in the last exercise. Use the names of the buyer and seller as found in the bill.

4. Copy the following account of a girl's receipts and expenditures, extend it another week, close it at the end of the week (Saturday) and reopen it Monday :

<p style="text-align:center">C<small>ASH</small>   *Dr.*   *Cr.*</p>

1914						
Dec.	*7*	*On hand*	*1*	*74*		
	9	*Allowance*		*75*		
	10	*Materials for hat*			*1*	*78*
	11	*Candy*				*10*
	12	*Gift from Uncle*	*1*	*50*		
		Renovating dress				*78*
		" *hat*				*75*
		Balance				*58*
			3	*99*	*3*	*99*
Dec.	*14*	*On hand*		*58*		

5. Find the cost of the following materials (*a*) for a straw hat : 1 piece straw braid, 79 ¢ ; wire for frame, 10 ¢ ; 1 yd. cotton mull, 10 ¢ ; 1 yd. silk (trimming), 69 ¢ ; lining, 10 ¢. (*b*) For renovating dress : 2½ yd. Pèrsian lawn @ 15 ¢; 5 yd. embroidery insertion @ $.08. (*c*) For renovating hat : ¾ yd. black silk @ 69 ¢ ; 1 ostrich quill, 23 ¢. The other materials were supplied by the old hat and the old dress.

SECTION V

PERCENTAGE, INTEREST, MEASUREMENTS, REVIEWS, SHORT METHODS

Percentage

Preparatory Exercises

1. Out of 12 examples worked by a boy, his answers to 10 of them were correct. What fraction of correct answers did he get?

2. Out of 16 examples worked by a girl, her answers to 14 of them were correct. What fraction of correct answers did she get?

3. Which fraction is greater, $\frac{5}{6}$ or $\frac{7}{8}$?

4. To compare $\frac{5}{6}$ and $\frac{7}{8}$ what is necessary?

5. What fraction of correct answers is obtained by a pupil that gets 12 correct answers to 15 examples?

6. What is the common denominator of the fractions $\frac{4}{5}$, $\frac{5}{6}$, and $\frac{7}{8}$?

7. How many cents (*a*) in $\$\frac{4}{5}$? (*b*) in $\$\frac{5}{6}$? (*c*) in $\$\frac{7}{8}$?

8. Change to per cents: (*a*) $\frac{4}{5}$; (*b*) $\frac{5}{6}$; (*c*) $\frac{7}{8}$.

9. (*a*) If a club wins 17 games out of 20, how many would it win out of a hundred at the same rate? (*b*) How many games out of a hundred should be won by a club that wins 21 out of 25?

10. Change to per cents: (*a*) $\frac{17}{20}$; (*b*) $\frac{21}{25}$.

11. Change to fractions:

a. 50% *b.* 12½% *c.* 6¼% *d.* 87½% *e.* ½% *f.* 12.5%

Written Exercises

1. A man bought a tract of land for $4500. What was his profit if he sold it at an advance (*a*) of 140 %? (*b*) Of 4½ %?   (*c*) Of 3.4 %?   (*d*) Of ¾ %?

PROCESS

(*a*) $4500   (*b*) $4500   (*c*) $4500
        1.40   .04½   .034
      ─────   ─────   ─────
     180000   2250   18000
       4500   18000   13500
     ─────   ─────   ─────
   $6300.00 *Ans.* $202.50 *Ans.* $153.00ᵩ *Ans.*

(*d*) $4500   Change the given per cent to a decimal
        .00¾   by pointing off in the former two decimal
      ─────   places in addition to any originally con-
     4)13500   tained therein.
      ─────   When there is a fraction in the original
     $33.75 *Ans.*

per cent, the latter may be written as a complex decimal,

---

2. Find:

a. 2⅔ % of $316   *b.* 205 % of 180 yd.   *c.* 83⅓ % of 150 bu.
d. 4⅛ % of 128 lb.   *e.* 138 % of $150   *f.* 31¼ % of $160

Sight Exercises

Give answers:

a. 12½ % of 648 sheep   *b.* ⅛ % of $648
c. 6¼ % of $176   *d.* 1/16 % of $176
e. 25 % of 488 tons   *f.* ¼ % of 40 T.
g. 50 % of 864 pounds   *h.* ½ % of 800 lb.
i. 33⅓ % of 969 yards   *j.* ⅓ % of $969
k. 16⅔ % of 468 gallons   *l.* ⅙ % of $486
m. 8⅓ % of 360 bushels   *n.* 1/12 % of $360

Written Exercises

1. A butcher bought sheep weighing 2592 pounds alive. What is the loss in weight if 66⅔ % of the live weight is lost in dressing, and in bones, etc., that are not eaten?

PROCESS

$$66\tfrac{2}{3}\% \text{ of } 2592 \text{ lb.} = \frac{\overset{864}{\cancel{2592}} \text{ lb.}}{1} \times \frac{2}{\cancel{3}} = 1728 \text{ lb.} \quad \textit{Ans.}$$

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2. Find the results:

a. 12½ % of $3888 b. 37½ % of $2688
c. 6¼ % of 8336 T. d. 62½ % of 3976 men
e. 33⅓ % of 3456 lb. f. 87½ % of 4304 cows
g. 16⅔ % of 6354 yd. h. 66⅔ % of 1236 da.
i. 8⅓ % of 5364 ft. j. 75 % of 4248 mi.

3. A farmer cultivates 87½ % of his farm of 365 acres. How many acres and square rods are cultivated?

PROCESS

$$87\tfrac{1}{2}\% \text{ of } 365 \text{ A.} = \tfrac{7}{8} \text{ of } \tfrac{365}{1} \text{ A.} = \tfrac{2555}{8} \text{ A.} = 319\tfrac{3}{8} \text{ A.}$$
$$= 319 \text{ A. } 60 \text{ sq. rd.} \quad \textit{Ans.}$$

NOTE. — ⅜ A. = ⅜ of 160 sq. rd.

---

4. Express results as compound denominate numbers:

a. 12½ % of 175 bu. b. 37½ % of 275 bu.
c. 6¼ % of 276 gal. d. 62½ % of 375 gal.
e. 25 % of 383 A. f. 87½ % of 481 A.
g. 50 % of 433 mi. h. 66⅔ % of 247 yd.
i. 33⅓ % of 52 wk. j. 75 % of 117 yr.
k. ⅔ % of 420 miles. l. ⅛ % of $960.

Sight Problems

1. A man insured his house for $500, at a cost of ½ of 1% of this amount. How much did it cost?

2. A boy has 36 marbles. How many would he have after losing 25% of them?

3. A baseball club played 40 games and won 87½% of them; how many games did it win?

4. In a class of 20 pupils 45% are girls; how many boys are there in the class?

5. John bought a dog for $2 and sold it for 30% more than he paid. How much did he receive for the dog?

6. Of the population of a certain village 5% caught the measles. If the population was 860, how many were taken sick with the measles?

7. A man placed 300 tons of hay in the barn. If it lost 2% in weight by the time he sold it, how many tons did it then weigh?

8. In selling a suit, a dealer makes a deduction of 10% on the marked price. If the marked price is $25, (*a*) how much is the deduction? (*b*) What is the selling price?

9. In a storm 2% of the trees in an orchard were blown down. If the orchard contained 150 trees, how many were blown down?

10. A girl buys eggs at 25 cents a dozen, and sells them for 20% more than they cost. (*a*) What does she receive a dozen for them? (*b*) How much does she receive for 10 eggs?

11. When the death rate in a city is 14.5 per thousand, what is the rate per cent?

Written Problems

1. A barn worth $4000 is insured for 85 % of its value. (*a*) For how much is it insured? (*b*) How much does the insurance cost at ¾ % of the sum for which it is insured?

2. A farmer has raised 3296 bushels of wheat. How many bushels has he after selling 25 % of the crop?

3. A club has played 40 games of ball and has won 72½ % of them. How many games has it lost?

4. In a class of 36 pupils 44⅔ % of them are boys : how many girls are there in the class?

5. A dealer bought a horse for $175 and sold it at 12 % more than the cost. What was the selling price?

6. In a village having a population of 860, 15 % of the population voted. How many votes were cast?

7. When 96 % of the pupils of a school are present, how many pupils are absent if there are 450 pupils belonging to the school?

8. A dealer advertises a reduction of 12 % on furniture. (*a*) How much is this reduction on a parlor set previously sold for $125? (*b*) What is the new price?

9. Four per cent of a man's crop of 175 bushels of apples were spoiled. How many bushels of sound apples were left?

10. A dealer pays $4.80 for a case of 30 dozen eggs. If he sells them at a profit of 12½ %, how much does he receive for them by the dozen?

11. How many deaths in a city of 12,000 inhabitants will give a death rate of 1.45 %?

12. After deducting 42 % of a number the remainder is 1160; what is the number?

13. After spending 40 % of my money for land and 25 % of it for stock, how much shall I have left of $ 30,000 ?

14. A man begins work at a salary of $ 1000. If he receives each year 10 % more than he received the previous year, what is his salary for the fourth year?

15. A road supposed to be 10 miles long is found to be 15 % of a mile short of that length. What is its length in miles and rods?

16. In a school of 120 pupils, 25 % are in room A, 30 % are in room B, 20 % are in room C, and the remainder are in room D. (*a*) How many are there in each room? (*b*) What per cent of the pupils are in room D?

17. A man loses 10 % of his money and then loses 20 % of the remainder. (*a*) What fraction of his money has he lost? (*b*) What per cent of his money?

18. C has $100. A has 10 % more money than B, and B has 10 % more than C. What per cent more money than C has A?

19. A dealer pays $40 for a table. He marks it 25 % above cost and sells it 10 % below the marked price. What does he receive for it?

20. When $2\frac{1}{2}$ % of a school of 520 pupils are absent, how many are present?

21. The weekly pay roll of a factory is $4500. What would it be if it were increased $7\frac{1}{2}$ %?

22. A merchant sold a bill of goods, amounting to $700, of which he received a payment of 75 % on account and a later payment of 80 % of the amount then due. (*a*) What amount is then unpaid? (*b*) What fraction of the original bill is unpaid? (*c*) What per cent?

Interest

THE LENDER

A person with spare money is anxious to increase his income by the rent received from another for its use. A sum as small as $1 can be loaned to the United States by means of a postal savings bank. Larger sums are loaned to a regular bank, to an individual, to a city, etc.

SECURITY FOR THE LOAN

A loan is frequently made to an individual without further security than his reputation for honesty. Loans to savings banks are safeguarded by the state. A loan to the owner of property is secured by the latter's written agreement to permit the sale of the property if the interest is not paid at the stated periods or the principal when due.

EVIDENCE OF THE LOAN

A person loaning money to the United States, to a city, to a railroad, etc., receives a document called a *bond*, which specifies the sum loaned, the time it is due, the rate of interest, and the dates of the interest payments.

A loan to a savings bank is acknowledged by the entry of the sum in the bankbook of the lender.

A loan to Paul Peters by Henry Beck is acknowledged by the following *promissory note*.

LINCOLN, NEBRASKA, Aug. 2, 1914

On demand after date I promise to pay to Henry Beck, or order, Six Hundred $\frac{00}{100}$ Dollars, value received, at my office, 136 Jackson Ave., with interest at six per cent.

600\frac{00}{100}$ PAUL PETERS

The Borrower

By borrowing $1000 for sixty days, a merchant is frequently able to take advantage of favorable prices, whereby he saves several times the interest on the sum borrowed. A manufacturer borrows money for the purchase of raw material, repaying it with interest when the products are sold. A railroad borrows money for a long period to make extensions, the income of which is expected to pay the interest charges and to supply funds for the payment of the principal at the specified time.

A town that needs a new $50,000 school is frequently unwilling to collect the entire cost in the taxes of a single year, preferring to spread it over ten or a dozen years by borrowing the money for that time, paying interest half yearly.

Sight Exercises

1. Considering a year to consist of 12 months of 30 days each, what is the interest on $600 at 6% (*a*) for 1 year? (*b*) For 1 day? (*c*) For 60 days? (*d*) For 93 days?

2. What fraction of a year is (*a*) 180 days? (*b*) 90 days? (*c*) 45 days? (*d*) 72 days? (*e*) 120 days? (*f*) 60 days? (*g*) 40 days?

$$Interest = Principal \times Rate \ (in \ hundredths) \times time \ (in \ years).$$

3. Give the interest on:

a. $100, at 6%, for $\frac{1}{6}$ yr.   b. $100, at 6%, for 60 da.
c. $200, at 5%, for $\frac{1}{5}$ yr.   d. $300, at 5%, for 72 da.
e. $300, at 8%, for $\frac{1}{8}$ yr.   f. $400, at 8%, for 45 da.
g. $400, at 4%, for $\frac{3}{4}$ yr.   h. $200, at 4%, for 90 da.
i. $500, at 6% for $\frac{2}{3}$ yr.   j. $600, at 6%, for 30 da.

Written Exercises

1. Mr. Peters borrows $275. He repays the loan in 2 years and 6 months with interest at 6%. How much does he pay?

PROCESS

Find the interest for 1 year by multiplying $275 (the principal) by .06 (the rate expressed as hundredths).

$275	Principal
×.06	Rate
$16.50	Interest for 1 yr.
× 2½	Time in years
8.25	
33.00	
$41.25	Interest for 2½ yr.
275	Principal
Ans. $316.25	Amount

Multiply $16.50 (the interest for 1 yr.) by 2½ (the time in years). To $41.25 (the interest) add $275 (the principal), which gives $316.25 (the amount).

The sum on which the interest is taken is called the *principal*.
The *amount* is the total of the principal and the interest.

2. Find the interest on :

a. $250 at 3% for 1 yr.   *b.* $360 at 5% for 2½ yr.

c. $180 at 4% for 3 yr.   *d.* $400 at 4% for 1¼ yr.

3. Find the amount of :

a. $250 at 5% for 1 yr.   *b.* $360 at 4% for 2½ yr.

c. $180 at 6% for 3 yr.   *d.* $400 at 5% for 1¼ yr.
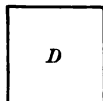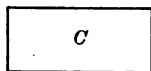
4. Find the interest on :

a. $250 at 6% for 6 mo.   *b.* $360 at 4½% for 30 da.

5. Find the amount of :

a. $250 at 4% for ¼ yr.   *b.* $360 at 6% for 60 da.

Quadrilaterals

A figure of four sides is called a *quadrilateral*. *A, B, C,* and *D* are quadrilaterals. When a quadrilateral has its opposite sides equal and parallel, it is called a *parallelogram*.
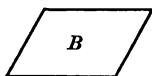
B, C, and *D* are parallelograms.

When the angles of a parallelogram are right angles, it is called a *rectangle*.

C and *D* are rectangles.

When a rectangle has four equal sides, it is called a *square*.

D is a square.

Take a strip of paper 2 inches wide and cut from it four parallelograms of different shapes, but each having a base 3 inches long.

The area of each of these parallelograms will be 6 sq. in.

Test the equality of these parallelograms by changing each into a rectangle 3″ × 2″. Do this by cutting along a perpendicular line *CX*, p. 213, and transferring the triangle *CXB* from the right to the left.

The dotted line in each of the parallelograms, corresponding with *CX*, is called the *altitude*, or the *perpendicular*. In the rectangle, the perpendicular is one of the sides. In parallelograms not rectangles, the line measuring the perpendicular is not one of the sides.

Any side of a parallelogram may constitute one of its dimensions, the perpendicular distance between this side and the one opposite being the other dimension.

Any two adjacent sides of a rectangle constitute its dimensions.

Areas of Parallelograms

To ascertain the area of the parallelogram *ABCD* measure the length of *AB* (or of *CD*) and also the length of the perpendicular *CX*.
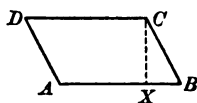
> *Area of parallelogram = Base × Perpendicular*

Sight Exercises

Give the area of each of the following parallelograms:

a. Base, 50 rods; perpendicular, 84 rods.

b. Base, 96 feet; perpendicular, 125 feet.

c. Base, 31 yards; perpendicular, 16 yards.

d. Base, 66 inches; perpendicular, $16\frac{2}{3}$ inches.

e. Base 75 feet; perpendicular 48 feet.

f. Base 48 miles; perpendicular $33\frac{1}{3}$ miles.

Written Exercises

Express each dimension in the linear unit corresponding to the square unit in which the area is required.

1. A field in the form of a parallelogram is $\frac{1}{2}$ mile long, and its perpendicular is 70 rods. How many acres does it contain?

2. How many square rods are there in a road a mile long and 66 feet wide?

3. How many square yards are there in a rectangular rug 8 yd. 2 ft. 8 in. long, 4 yd. 1 ft. 6 in. wide?

4. An acre contains 4840 square yards. How many acres are there in a field whose dimensions are 330 feet by 132 feet?

5. Find the area (in acres) of a square field whose perimeter is 320 rods.

Areas of Triangles

The triangle ABC is one half the area of the parallelogram $ABCX$.

Since the area of the parallelogram is the product of BC by AY, the area of the triangle ABC is $\frac{1}{2}$ the product of BC by AY.
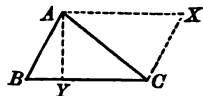
Area of triangle $= \frac{1}{2}$ (Base $\times$ Perpendicular)

Preparatory Exercises

The triangle ABC is divided into two right triangles by the perpendicular AY. When the length of AY is 2 inches, that of BY 1 inch, and that of CY 3 inches,

a. How long is BC?

b. What is the area of ABY?

c. Give the area of AYC.

d. What is the sum of these areas?

e. Give the area of ABC.

Sight Exercises

Give the area of triangles having dimensions as follows :

a. Base, $37\frac{1}{2}$ rods ; perpendicular, 64 rods.

b. Base, $16\frac{2}{3}$ yards ; perpendicular 36 feet.

c. Base, $62\frac{1}{2}$ feet ; perpendicular, 96 inches.

d. Base, $8\frac{1}{3}$ yards ; perpendicular 36 feet.

Written Exercises

1. How many acres are there in a triangular field whose base measures 480 rods and whose altitude is 76 rods ?

2. A triangular field contains 4 acres. What is its altitude when the base is a mile in length ?

Surfaces of Rectangular Solids

The *entire surface* of a rectangular solid includes all six faces. The *convex surface* excludes the two bases.

The accompanying figure shows the diagram of a piece of paper that would exactly cover a solid 6 in. high, 4 in. long, 2 in. wide. Calling the two rectangles X and Y the bases, the rectangle $ABCD$ represents the convex surface.
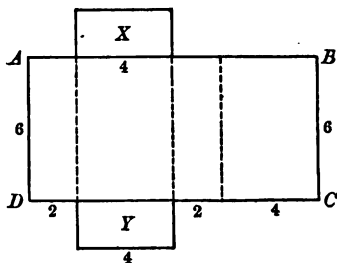
Sight Exercises

1. What is the area of each of the bases?

2. What is the area of each of the two largest faces?

3. What is the area of the two remaining faces?

4. What is the area of $ABCD$?

Convex Surface = Perimeter of Base × Altitude

Written Exercises

1. (*a*) What is the convex surface of a cube each side of which is 15 in.? (*b*) What is the entire surface?

2. A room is 15 feet long, 12 feet wide, and 9 feet high. (*a*) How many square yards of plastering does the ceiling require? (*b*) How many running yards of plastering 9 feet high are required for the walls? (*c*) How many square yards of plastering are required, allowing 12 sq. yd. for openings? (*d*) How many square yards of carpet are needed to cover the floor?

Volumes of Rectangular Solids

Written Exercises

1. How many cubic feet of corn are there in a corn crib 16 ft. long and 12 ft. wide when the corn is 8 ft. deep ?

2. (*a*) How many cubic feet of earth are removed in digging a cellar 48 ft. long, 21 ft. wide, and 9 ft. deep ? (*b*) How many tons does it weigh at 21 cu. ft. to the ton ?

3. (*a*) How many cubic inches are there in a brick 8″ × 4″ × 2″ ? (*b*) How many bricks are there to the cubic foot ? (*c*) How many cubic inches are there in a brick 8″ × 4″ × 2½″ ?

4. At 21 bricks (including mortar) to the cubic foot, how many bricks are required for a wall 150 ft. long, 1 ft. thick, 6 ft. high ?

5. (*a*) How many cubic feet are there in a piece of lumber 12 ft. long, 6 in. wide, and 6 in. thick ? (*b*) What is its weight at 36 pounds to the cubic foot ?

6. (*a*) How many cubic feet are there in a block of ice 4 ft. long, 2 ft. wide, 1½ ft. thick? (*b*) What is its weight at 58 pounds to the cu. ft. ? (*c*) Find the weight of an equal volume of water at 62½ lb. to the cu. ft.

Sight Exercises

Give the areas of the following rectangles in square units corresponding with the given linear units :

a. 16 ft. by 25 ft.   *b.* 99 ft. by 99 ft.
c. 24 yd. by 12½ yd.   *d.* 99 rd. by 51 rd.
e. 36 rd. by 33⅓ rd.   *f.* 21 in. by 13 in.
g. 20 in. by 8.5 in.   *h.* 88 yd. by 25 yd.
i. 40 mi. by 6.1 mi.   *j.* 60 rd. by 16⅔ rd.

Sight Drills

1. Give sums:

$$749 + 134 = 749 + 100(849) + 30(879) + 4$$

a. $175 + 84$	*b.* $672 + 126$	*c.* $861 + 129$	*d.* $363 + 154$
e. $263 + 95$	*f.* $715 + 243$	*g.* $758 + 137$	*h.* $281 + 176$
i. $346 + 63$	*j.* $804 + 155$	*k.* $639 + 143$	*l.* $377 + 162$
m. $451 + 78$	*n.* $533 + 233$	*o.* $527 + 164$	*p.* $465 + 153$
q. $572 + 54$	*r.* $441 + 156$	*s.* $446 + 138$	*t.* $548 + 181$

2. Give remainders:

$$321 - 176 = 321 - 100(221) - 70(151) - 6(145)$$

a. $960 - 84$	*b.* $798 - 132$	*c.* $320 - 186$	*d.* $513 - 184$
e. $847 - 98$	*f.* $958 - 416$	*g.* $430 - 237$	*h.* $418 - 179$
i. $753 - 69$	*j.* $839 - 527$	*k.* $540 - 194$	*l.* $346 - 197$
m. $624 - 37$	*n.* $766 - 643$	*o.* $650 - 263$	*p.* $221 - 165$
q. $516 - 69$	*r.* $647 - 208$	*s.* $760 - 482$	*t.* $352 - 188$

3. Give products:

$$16\tfrac{2}{3} \times 7\cancel{c} = 16\tfrac{2}{3}\cancel{c} \times 7 = \$\tfrac{1}{6} \times 7 = \$\tfrac{7}{6} = \$1.16\tfrac{2}{3}$$

a. $48 \times 16\tfrac{2}{3}\cancel{c}$	*b.* $49 \times 16\tfrac{2}{3}\cancel{c}$	*c.* $54 \times 16\tfrac{2}{3}\cancel{c}$	*d.* $16\tfrac{2}{3} \times 7\cancel{c}$
e. $48 \times 33\tfrac{1}{3}\cancel{c}$	*f.* $49 \times 33\tfrac{1}{3}\cancel{c}$	*g.* $96 \times 12\tfrac{1}{2}\cancel{c}$	*h.* $12\tfrac{1}{2} \times 9\cancel{c}$
i. $48 \times 12\tfrac{1}{2}\cancel{c}$	*j.* $49 \times 12\tfrac{1}{2}\cancel{c}$	*k.* $88 \times 37\tfrac{1}{2}\cancel{c}$	*l.* $33\tfrac{1}{3} \times 8\cancel{c}$
m. $48 \times 66\tfrac{2}{3}\cancel{c}$	*n.* $49 \times 66\tfrac{2}{3}\cancel{c}$	*o.* $69 \times 66\tfrac{2}{3}\cancel{c}$	*p.* $66\tfrac{2}{3} \times 4\cancel{c}$
q. $48 \times 83\tfrac{1}{3}\cancel{c}$	*r.* $49 \times 83\tfrac{1}{3}\cancel{c}$	*s.* $66 \times 83\tfrac{1}{3}\cancel{c}$	*t.* $83\tfrac{1}{3} \times 5\cancel{c}$

4. Give answers:

$$31 \div 16\tfrac{2}{3}\% = 31 \div \tfrac{1}{6} = 31 \times 6$$

a. $16\tfrac{2}{3}\%$ of 126	*b.* $126 \times 16\tfrac{2}{3}$	*c.* $31 \div 16\tfrac{2}{3}\%$
d. $33\tfrac{1}{3}\%$ of 189	*e.* $189 \times 33\tfrac{1}{3}$	*f.* $43 \div 33\tfrac{1}{3}\%$
g. $12\tfrac{1}{2}\%$ of 168	*h.* $168 \times 12\tfrac{1}{2}$	*i.* $51 \div 12\tfrac{1}{2}\%$
j. $66\tfrac{2}{3}\%$ of 180	*k.* $180 \times 66\tfrac{2}{3}$	*l.* $60 \div 66\tfrac{2}{3}\%$
m. $83\tfrac{1}{3}\%$ of 120	*n.* $120 \times 83\tfrac{1}{3}$	*o.* $60 \div 83\tfrac{1}{3}\%$

Sight Problems

1. A farmer sold 1600 bushels of rye at 62¼ cents per bushel. (*a*) What did he receive for it? (*b*) How much less would it have brought if he had obtained only 62 ¢ per bushel? (*c*) How much more if the price were 63 ¢ per bushel?

2. A crop of 1250 bushels lost 1 % through various causes. (*a*) How many bushels were lost? (*b*) How many remained? (*c*) Find 99 % of 1250.

3. At an election A received 284 votes and B 147. (*a*) How many did both receive? (*b*) How many more did A receive than B?

4. What is the cost of 168 yards at 62½ ¢ per yard?

5. Find the number of square feet in a floor 16⅔ ft. wide and 24 ft. long.

6. (*a*) How many square yards in a roll of carpet 48 yd. long and ¾ yd. wide? (*b*) How many yards of carpet ¾ yd. wide will contain 48 sq. yd.? (*c*) What fraction of a yard is the width of a piece of carpet 16 yards long that contains 12 square yards? (*d*) What is the width of a piece of oilcloth 12 yards long that contains 16 square yards?

7. (*a*) At 37½ miles per hour, how far will a train go in 24 hours? (*b*) At 37½ miles per hour how long will a train require to go 480 miles?

8. (*a*) How much cooked meat will 24 pounds of raw meat supply when 25 % of the weight of the latter is lost in cooking? (*b*) A hotel keeper needs 24 pounds of cooked meat. How many pounds must he get from the butcher to obtain this quantity, allowing for a loss of 25 % of its weight in cooking?

Review — Adding Whole Numbers

Written Exercises

1. The following are the monthly receipts of a butcher:
Jan., $1646.28; Feb., $1239.74; Mch., $1735.95;
Apr., $1596.87; May, $1548.36; June, $1463.88; July,
$1356.48; Aug., $1283.76; Sept., $1495.89; Oct.,
$1538.65; Nov., $1605.67; Dec., $1896.77.

Find the total for the year.

$ 1646.28		**PROCESS**
1239.74		
1735.95		Adding upwards, think 14, 19, 28, 34, 42,
1596.87		50, 56, 63, 68, 72, 80. Write 80.
1548.36	80	Carrying 8, think 15, 21, 27, 35, 42, 46, 54,
1463.88	83	57, 65, 74, 81, 83. Write 83, etc. When you
1356.48	etc.	have written the total of the last column,
1283.76	etc.	cover these totals with a strip of paper, and
1495.89	etc.	write on the latter the totals of the columns,
1538.65	etc.	adding downwards. Compare the two sets.
1605.67		If they agree, write the result in its proper
1896.77		place.

2. The accounts of a housekeeper show expenditures
as follows during the year:

Rent, $180; food, $393.85; clothing, $60.98; fuel
and light, $55.15; furniture, $11.79; insurance, $26.36;
medical, $38.61; contributions, $10.36; recreation, $7.68;
reading, $8.34; miscellaneous, $60.71.

(*a*) What is the total for the year?   (*b*) How much
cash should she have on hand after paying all bills, if she
receives $20 per week, and deposits $15 per month in the
savings bank?

"Side" Calculations

As a rule, business men omit superfluous figures. The writing of the total of each column in a long addition is, however, considered an advantage, inasmuch as the employment of these "side" totals makes it easier to locate a mistake in case of a discrepancy between the two footings.

3. Add horizontally and vertically :

a.	\$3,486.59 +	\$2,564.35 +	\$1,957.83 = ?
b.	769.94 +	8,874.66 +	396.64 = ?
c.	1,999.87 +	565.47 +	2,877.69 = ?
d.	2,538.65 +	6,363.25 +	655.58 = ?
e.	656.48 +	777.76 +	3,996.86 = ?
f.	3,075.98 +	3,680.58 +	693.47 = ?
g.	395.76 +	965.27 +	879.68 = ?
h.	6,425.39 +	877.39 +	3,572.77 = ?
i.	595.73 +	57.66 +	1,483.94 = ?
j.	1,867.58 +	5,906.48 +	68.77 = ?
	k +	*l* +	*m* = *n*

Find the sum of each of the lines, *a–j*. Find the sum of each of the columns, *k–n*. Test the result by covering (*n*) with a piece of paper and writing on it the sum of *k*, *l*, and *m*.

4. Add:

a.	9,568,437 +	534,652 +	77,864 = ?
b.	499,678 +	6,647,889 +	493,845 = ?
c.	1,789,975 +	274,676 +	772,573 = ?
d.	568,352 +	523,858 +	4,869,788 = ?
e.	84,656 +	1,846,095 +	47,396 = ?
f.	395,073 +	656,757 +	686,993 = ?
g.	4,079,586 +	93,876 +	743,965 = ?
	h +	*i* +	*j* = *k*

Multiplying Whole Numbers

Written Exercises

1. At the rate of 459 rails per day, how many rails would be made by a factory in 328 days?

PROCESS	TEST
459 rails	328
328	459 rails
3672 product by 8 ones	2952 product by 9 ones
14688 product by 32 tens	14760 product by 45 tens
Ans. 150,552 rails	*Ans.* 150,552 rails

2. Multiply.   Test.   Use only two partial products.

a. 357 × 328   *b.* 426 × 287   *c.* 284 × 369
d. 637 × 246   *e.* 273 × 486   *f.* 364 × 549
g. 568 × 248   *h.* 459 × 427   *i.* 324 × 639
j. 279 × 186   *k.* 164 × 147   *l.* 183 × 189

3. How many square feet are there in a rectangular plot 864 ft. wide, 936 ft. long?

PROCESS	TEST
864 (ft.)	936 (ft.)
936 (ft.)	864 (ft.)
7776 Product by 9 hundreds	7488 Product by 8 hundreds
31104 Product by 36 ones	59904 Product by 64 ones
Ans. 808704 (sq. ft.)	*Ans.* 808704 (sq. ft.)

4. Find products.   Test.

a. 327 × 972   *b.* 872 × 756   *c.* 927 × 749
d. 763 × 436   *e.* 428 × 856   *f.* 654 × 945
g. 318 × 963   *h.* 864 × 735   *i.* 954 × 642
j. 432 × 936   *k.* 742 × 824   *l.* 624 × 882

Blackboard Exercises

Adding and Subtracting in one Operation

1. A farmer's receipts for 1915 included
\$2134.91 for grain, \$298.74 for vegetables,
\$134.80 for poultry, \$345.70 for hay, \$416 for
eggs, and \$362.76 for milk. How much less
than \$4000 were the receipts?

Write out the complete answer directly from the book.

$$
\begin{array}{r}
\$4000.\!-\!\!-\!\!- \\ \hline
2134.91 \\
298.74 \\
134.80 \\
345.70 \\
416.00 \\
362.76 \\ \hline
7.09
\end{array}
$$

2. From the number at the top, deduct the sum of the
other numbers. Write the answers directly from the book.

a.	*b.*	*c.*	*d.*
6758	5643	9578	7769
1234	874	3966	876
869	1065	475	3456
475	398	1357	248
2064	627	818	1459
?	?	?	?

Multiplying and Adding

3. What is the total weight of 9 bags of oats weighing 64 pounds each and a package of butter weighing 27 pounds?

PROCESS

(64 lb. × 9) + 27 lb. = 603 lb. *Ans.* Think 36 (9 × 4); 43, adding 7. Write 3.

Think 54 (9 × 6); 58, carrying 4; 60, adding 2. Write 60.

---

4. Change the following mixed numbers to improper fractions. Write the answers directly from the book.

     a. $9\frac{27}{64}$ *b.* $8\frac{5}{36}$ *c.* $12\frac{7}{15}$ *d.* $23\frac{8}{9}$ *e.* $64\frac{5}{9}$

Multiplying and Subtracting

5. Of his crop of 603 bushels of oats a farmer has sold
9 loads of 64 bushels each. How many bushels remain?

PROCESS

603 bu. $-$ (9 $\times$ 64 bu.)$=$ 27 bu. *Ans.*

Think 36 (9 $\times$ 4) and 7 (writing 7) are 43.

Think 54 (9 $\times$ 6), 58 (carrying 4), and 2 (writing 2) are 60.

---

6. Write only the answers :

a. $160-(7\times21)$ *b.* $250-(3\times71)$ *c.* $330-(7\times41)$

d. $150-(7\times19)$ *e.* $250-(3\times69)$ *f.* $330-(7\times39)$

7. At $64 per acre, how many acres of land would cost
$603 ?

PROCESS

$64\overline{)603}$

Ans. $9\frac{27}{64}$ A.

Write 9 for the whole number in the quotient
and 64 as the denominator of the fractional part.
Think 36 (9 $\times$ 4) and 7 (writing 7 in the num-
erator) are 43 ; etc.

---

8. Write only the answers :

a. $147\overline{)160}$ *b.* $213\overline{)250}$ *c.* $287\overline{)330}$

d. $21\overline{)160}$ *e.* $71\overline{)250}$ *f.* $41\overline{)330}$

g. $19\overline{)160}$ *h.* $69\overline{)240}$ *i.* $39\overline{)330}$

j. $\frac{160}{19}=8\frac{7}{19}$ *k.* $\frac{250}{69}=3\frac{7}{69}$ *l.* $\frac{330}{39}=8\frac{7}{39}$

Divisibility of Numbers

In reducing fractions to lower terms and in other forms of cancellation it is useful to be able to determine some numbers that are exact divisors of a given number.

When the division of one number by another gives a whole number for the quotient, the former number is said to be a *multiple* of the latter.

A number that is divisible by 2 is called an *even number*, and ends in 2, 4, 6, 8, or 0.

Sight Exercises

1. State which of the following numbers is divisible by 2 : *a.* 138. *b.* 217. *c.* 450. *d.* 1296. *e.* 2347.

A number is divisible by 3 when the sum of its digits is divisible by 3. By 9 when the sum of its digits is divisible by 9.

Thus 168 is divisible by 3 since $1 + 6 + 8$ (15) is divisible by 3; 468 is divisible by 9 since $4 + 6 + 8$ (18) is divisible by 9.

2. State which of the following numbers is divisible (i) by 2; (ii) by 3; (iii) by 9.

a. 84. *b.* 138. *c.* 217. *d.* 450. *e.* 774. *f.* 1296.

A number is divisible by 5 when it ends in 5 or 0.

3. State which of the following numbers is divisible (i) by 5; (ii) by 3; (iii) by 2; (iv) by 9.

a. 175. *b.* 225. *c.* 420. *d.* 375. *e.* 1760. *f.* 2004.

An even number that is divisible by 3 is divisible by 6.

A number is divisible by 4 or by 25 when its last two figures are ciphers, or are divisible by 4 or by 25.

4. State which of the following numbers is divisible (i) by 6; (ii) by 9; (iii) by 4; (iv) by 25.

a. 76050. *b.* 75060. *c.* 28200. *d.* 20820. *e.* 26820.

Reducing Fractions

Sight Exercises

1. Express in lowest terms :

a. $\frac{24}{36}$ *b.* $\frac{40}{56}$ *c.* $\frac{15}{60}$ *d.* $\frac{17}{51}$ *e.* $\frac{32}{72}$ *f.* $\frac{35}{77}$ *g.* $\frac{25}{80}$

h. $\frac{25}{55}$ *i.* $\frac{24}{72}$ *j.* $\frac{48}{84}$ *k.* $\frac{25}{40}$ *l.* $\frac{36}{60}$ *m.* $\frac{42}{48}$ *n.* $\frac{75}{90}$

When the numerator of a fraction is a prime number, it cannot be reduced unless the denominator is a multiple of the numerator.

2. Reduce :

a. $\frac{29}{116}$ *b.* $\frac{17}{119}$ *c.* $\frac{23}{115}$ *d.* $\frac{13}{117}$ *e.* $\frac{37}{111}$ *f.* $\frac{53}{159}$

g. $\frac{19}{114}$ *h.* $\frac{41}{205}$ *i.* $\frac{31}{248}$ *j.* $\frac{47}{235}$ *k.* $\frac{61}{305}$ *l.* $\frac{43}{344}$

Sight or Written Exercises

3. Reduce to lowest terms :

NOTE. — Examine each fraction as to the divisibility of both terms by 2, by 3, by 5, etc. Divide both terms by such number, and examine the new fraction in the same way.

a. $\frac{875}{1000}$ *b.* $\frac{168}{288}$ *c.* $\frac{160}{192}$ *d.* $\frac{147}{245}$ *e.* $\frac{250}{625}$

f. $\frac{875}{1000}$ *g.* $\frac{96}{216}$ *h.* $\frac{240}{600}$ *i.* $\frac{120}{288}$ *j.* $\frac{147}{196}$

Written Exercises

1. Reduce $\frac{161}{253}$ to lowest terms.

Since in this fraction a common factor is not readily found by inspection, use the method for finding the greatest common divisor given on page 138.

2. Express in lowest terms :

a. $\frac{78}{169}$ *b.* $\frac{85}{102}$ *c.* $\frac{76}{171}$ *d.* $\frac{145}{203}$ *e.* $\frac{115}{184}$

f. $\frac{93}{248}$ *g.* $\frac{185}{333}$ *h.* $\frac{133}{451}$ *i.* $\frac{172}{645}$ *j.* $\frac{235}{423}$

Adding Mixed Numbers

Written Exercises

1. Find the total surface of six boiler plates containing respectively, $2\frac{7}{9}$ sq. ft., $13\frac{1}{8}$ sq. ft., $25\frac{13}{16}$ sq. ft., $7\frac{5}{6}$ sq. ft. $18\frac{1}{2}$ sq. ft., and $\frac{3}{4}$ sq. ft.

		144	PROCESS
$2\frac{7}{9}$	16	112	Place in the first col-
$13\frac{1}{8}$	—	48	umn the quotients of
$25\frac{13}{16}$	9	117	144 by the denominators
$7\frac{5}{6}$	24	120	9, 16, 6, and 4, respec-
$18\frac{1}{2}$	—	72	tively. Write in the
$\frac{3}{4}$	36	108	second column the quo-

Ans. $69\frac{1}{144}$ (sq. ft.) | $\frac{577}{144} = 4\frac{1}{144}$ | tients of 144 by 3, and 2, respectively. In the second column write the

product of each quotient in column one by the appropriate numerator.

Use no figures other than those given above.

2. Add. Do not employ the extra column unnecessarily :

$a.$ $16\frac{3}{16} + 5\frac{1}{9} + 12\frac{3}{4} + 8\frac{7}{12} + 32\frac{19}{36} + 1\frac{17}{24}.$

L. C. M.	
$2)16 - 36 - 24$	In finding the least common multiple omit the
$\underline{2)\ 8 - 18 - 12}$	denominators 9, 4, and 12, which are factors of
$\underline{2)\ 4 - \ 9 - \ 6}$	36.
$\ \ \ 2 - \ 9 - \ 3$	

$b.$ $25\frac{1}{8} + 6\frac{3}{5} + 18\frac{3}{10} + 7\frac{1}{9} + 20\frac{1}{6} + 5\frac{7}{12}.$

$c.$ $10\frac{4}{7} + 6\frac{5}{12} + 20\frac{5}{8} + 3\frac{1}{4} + 13\frac{5}{6} + 3\frac{1}{8}.$

$d.$ $42\frac{3}{10} + 4\frac{2}{9} + 15\frac{1}{3} + 5\frac{3}{8} + 10\frac{1}{4} + 2\frac{5}{6}.$

$e.$ $39\frac{1}{2} + 6\frac{3}{7} + 16\frac{4}{9} + 7\frac{3}{16} + 15\frac{1}{3} + 3\frac{5}{8}.$

Review — Subtracting Mixed Numbers

Preparatory Exercises

1. Give answers:

a. $25 - 23 = ?$ b. $25 + 17 - 23 = ?$ c. $25 + 19 - 23 = ?$

How much more than 2 is the result in (a)? In (b)?

2. Subtract:

a. $1 - \frac{23}{25} = ?$ b. $1\frac{17}{25} - \frac{23}{25} = ?$ c. $1\frac{19}{25} - \frac{23}{25} = ?$

In subtracting $\frac{23}{25}$ from $1\frac{17}{25}$ take $\frac{23}{25}$ from 1, and to the result add $\frac{17}{25}$.

3. Give answers:

$$a.\quad 40 \\ \underline{-\ 39\tfrac{23}{25}}$$

$$b.\quad 40\tfrac{17}{25} \\ \underline{-\ 39\tfrac{23}{25}}$$

$$c.\quad 40\tfrac{19}{25} \\ \underline{-\ 39\tfrac{23}{25}}$$

$$d.\quad 40\tfrac{19}{25} \\ \underline{-\ 20\tfrac{23}{25}}$$

Written Exercises

1. Mr. Newman's crop this year averaged $165\frac{13}{16}$ bushels of potatoes to the acre. Last year it averaged $147\frac{23}{24}$ bushels. What is the increase?

PROCESS		
	120	Take $\frac{13}{16}$ from 1, leaving $\frac{5}{120}$. To
$165\frac{13}{16}$ ⎸ 8	104	this add $\frac{19}{24}$, which gives $\frac{19}{120}$. This is
$147\frac{23}{24}$ ⎸ 5	115	the difference between $1\frac{19}{24}$ and $\frac{13}{16}$.
Ans. $17\frac{19}{120}$ (bu.)	$\frac{19}{120}$	

2. Find answers:

$$a.\quad 200\tfrac{3}{8} \\ \underline{-\ 83\tfrac{9}{10}}$$

$$b.\quad 423\tfrac{1}{4} \\ \underline{-\ 234\tfrac{17}{18}}$$

$$c.\quad 164\tfrac{4}{5} \\ \underline{-\ 10\tfrac{7}{8}}$$

$$d.\quad 604\tfrac{4}{5} \\ \underline{-\ 345\tfrac{11}{12}}$$

$$e.\quad 483\tfrac{11}{16} \\ \underline{-\ 60\tfrac{11}{12}}$$

$$f.\quad 722\tfrac{5}{6} \\ \underline{-\ 456\tfrac{20}{21}}$$

$$g.\quad 350\tfrac{3}{8} \\ \underline{-\ 75\tfrac{9}{10}}$$

$$h.\quad 890\tfrac{7}{8} \\ \underline{-\ 678\tfrac{9}{10}}$$

Some Short Cuts

Some of the following methods may be used in testing a result obtained in the ordinary way.

Written Exercises

1. A merchant imported (*a*) 866 yards of dress goods $\frac{7}{8}$ yd. (31$\frac{1}{2}$ in.) wide; (*b*) 942 yards, $\frac{8}{9}$ yd. (32 in.) wide. How many square yards were there in each lot?

PROCESS

(*a*)   866 × $\frac{7}{8}$

   108$\frac{1}{4}$ Deduct $\frac{1}{8}$

Ans. 757$\frac{3}{4}$ (sq. yd.)

(*b*)   942 × $\frac{8}{9}$

   104$\frac{2}{3}$ Deduct $\frac{1}{9}$

Ans. 837$\frac{1}{3}$ (sq. yd.)

Cover the original results and test (*a*) by multiplying 108$\frac{1}{4}$ by 7, and (*b*) by multiplying 104$\frac{2}{3}$ by 8.

---

2. Multiply:

a. 437 × $\frac{3}{4}$ *b.* 1946 × $\frac{6}{7}$ *c.* 1453 × $\frac{12}{13}$

d. 764 × $\frac{7}{8}$ *e.* 1875 × $\frac{8}{9}$ *f.* 2234 × $\frac{10}{11}$

g. 521 × $\frac{2}{3}$ *h.* 1744 × $\frac{5}{6}$ *i.* 2485 × $\frac{11}{12}$

3. What is the cost (*a*) of 487 bushels of rye at 79$\frac{3}{4}$¢? Of 565 bushels of wheat at 99$\frac{7}{8}$¢?

PROCESS

(*a*) 487 @ 79$\frac{3}{4}$¢

   $389.60 @ 80¢

     1.21$\frac{3}{4}$ @ $\frac{1}{4}$¢

   388.38\frac{1}{4}$

Ans. $388.38

(*b*) 565 @ 99$\frac{7}{8}$¢

   $565.— @ $1

     .70$\frac{5}{8}$ @ $\frac{1}{8}$¢

   564.29\frac{3}{8}$

Ans. $564.29

(*a*) From 80 times 487 take $\frac{1}{4}$ times 487.
(*b*) From 100 times 565 take $\frac{1}{8}$ times 565.

---

4. Multiply:

  a. 867 × 9⅔   *b.* 539 × 39⅘   *c.* 1234 × 99¾

  d. 943 × 19¾   *e.* 624 × 59⅚   *f.* 2345 × 49⅞

5. How many yards of silk can be bought for \$250 when the price per yard is (*a*) \$⅔? (*b*) \$¾? (*c*) \$⅚?

PROCESS

  (*a*) 250 × 1½   (*b*) 250 × 1⅓   (*c*) 250 × 1⅕

     125 Add ½   83⅓ Add ⅓   50 Add ¼

Ans. 375 (yd.)   *Ans.* 333⅓ (yd.)   *Ans.* 300 (yd.)

  (*a*) To divide by ⅔ multiply by ⅜, or 1½. (*b*) To divide by ¾ multiply by ⅘, or 1⅓. (*c*) To divide by ⅚ multiply by ⅚, or 1⅕.

---

6. Divide:

  a. 849 ÷ ¾   *b.* 963 ÷ ¾   *c.* 747 ÷ ¾   *d.* 375 ÷ ⅚

  e. 490 ÷ ⅚   *f.* 585 ÷ ⅚   *g.* 512 ÷ ⅞   *h.* 576 ÷ ⅞

7. How many yards of cloth can be bought for \$480 at the rate per yard of (*a*) \$1.50? (*b*) \$1.33⅓? (*c*) \$1.25?

PROCESS

    (*a*)   (*b*)   (*c*)

480 × ⅔   480 × ¾   480 × ⅘

160 Deduct ⅓   120 Deduct ¼   96 Deduct ⅕

320 (yd.) *Ans.*   360 (yd.) *Ans.*   384 (yd.) *Ans.*

  (*a*) To divide by 1½, multiply by ⅔; (*b*) to divide by 1⅓, multiply by ¾; (*c*) to divide by 1¼, multiply by ⅘, using the method given on the preceding page.

---

8. Find quotient:

  a. 849 ÷ 1½   *b.* 964 ÷ 1⅓   *c.* 745 ÷ 1¼   *d.* 384 ÷ 1⅕

  e. 847 ÷ 1⅙   *f.* 976 ÷ 1⅐   *g.* 747 ÷ 1⅛   *h.* 360 ÷ 1⅑

Sight Exercises

1. If a factory consumes an average of $121\frac{2}{5}$ tons of coal per month, how many tons will be required for two years?

<table>
<tr><td></td><td colspan="2" align="center">PROCESS</td></tr>
<tr><td></td><td>$121\frac{2}{5}$ T.
$\times\,24$</td><td>Think $4\frac{4}{5}$ ($24 \times \frac{2}{5}$), or $9\frac{3}{5}$. Write $\frac{3}{5}$. Think 24, 33 (carrying 9). Write 3. Think 48 (24 $\times$ 2), 51 (carrying 3). Write 3. Think 24, 29 (carrying 5). Write 29.</td></tr>
<tr><td>*Ans.*</td><td>$2913\frac{3}{5}$ T.</td><td></td></tr>
</table>

2. Write products directly from the book :

a. $\quad 138\frac{3}{8}$	*b.* $\quad 275\frac{5}{11}$	*c.* $\quad 328\frac{4}{7}$	*d.* $\quad 268\frac{2}{5}$
$\times\ 8$	$\times\ 11$	$\times\ 7$	$\times\ 10$
e. $\quad 348\frac{4}{9}$	*f.* $\quad 123\frac{3}{5}$	*g.* $\quad 357\frac{7}{8}$	*h.* $\quad 210\frac{5}{8}$
$\times\ 9$	$\times\ 10$	$\times\ 8$	$\times\ 16$
i. $\quad 263\frac{1}{2}$	*j.* $\quad 301\frac{1}{5}$	*k.* $\quad 234\frac{1}{9}$	*l.* $\quad 121\frac{1}{2}$
$\times\ 7$	$\times\ 13$	$\times\ 9$	$\times\ 15$

3. Write quotients :

a. $3)138\frac{3}{8}$	*b.* $5)275\frac{5}{11}$	*c.* $4)328\frac{4}{7}$	*d.* $2)268\frac{2}{5}$
e. $4)348\frac{4}{9}$	*f.* $3)123\frac{3}{5}$	*g.* $7)357\frac{7}{8}$	*h.* $5)210\frac{5}{8}$
i. $2)263\frac{1}{8}$	*j.* $6)301\frac{1}{5}$	*k.* $3)234\frac{1}{9}$	*l.* $5)122\frac{1}{2}$

4. Write answers :

a. $\frac{1}{8}$ of $138\frac{3}{8}$	*b.* $\frac{1}{5}$ of $275\frac{5}{11}$	*c.* $\frac{1}{4}$ of $328\frac{4}{7}$
d. $\frac{1}{2}$ of $268\frac{2}{5}$	*e.* $\frac{1}{4}$ of $348\frac{4}{5}$	*f.* $\frac{1}{3}$ of $123\frac{3}{5}$
g. $\frac{1}{7}$ of $357\frac{7}{8}$	*h.* $\frac{1}{5}$ of $210\frac{5}{8}$	*i.* $\frac{1}{2}$ of $263\frac{1}{8}$
j. $\frac{1}{6}$ of $301\frac{1}{5}$	*k.* $\frac{1}{3}$ of $234\frac{1}{9}$	*l.* $\frac{1}{5}$ of $122\frac{1}{2}$

Written Exercises

1. What is the cost of 1422⅔ yards of calico at 6½ cents per yard?

```
                    PROCESS
  1422⅔
  $.06½         When the fractional part of the mixed num-
  ────          ber used as a multiplier has a unit numerator,
  8536          do not change mixed numbers to improper
   711⅓         fractions.  To 6 times 1422⅔ add ½ of 1422⅔.
  ─────
  $92.47⅓  Ans.
```

2. Find products. Do not change mixed numbers to improper fractions.

a. 138⅔   *b.* 275 5/11   *c.* 328¼   *d.* 268⅖
    × 8⅓   × 11½   × 7¼   × 10½

e. 348⅘   *f.* 123⅗   *g.* 357⅞   *h.* 210⅚
    × 9¼   × 10⅜   × 8⅐   × 12⅙

i. 263⅛   *j.* 301⅕   *k.* 234⅓   *l.* 122½
    × 7½   × 13⅙   × 9⅓   × 15⅕

3. Add the following:

24⅓, 6¼, 39⅐, 48⅔, 7⅔, 84⅜.

Combine ⅓ and ⅔, ¼ and ⅔. Write 5/9 (⅓ + ⅔) and carry 2 to the whole numbers.

4. Find sums:

a. 6½   *b.* 20⅛   *c.* 12⅔   *d.* 36⅔   *e.* 6⅝
   10¾   26⅙   6⅙   17⅘   20 7/12
   18⅘   14½   5⅐   9⅔   12⅜
   23⅓   24⅘   8⅔   38⅚   8 5/12
    9¼   8¼   16⅓   ⅕   10¼
   42½   7⅞   94⅘   23⅛   6⅕

Sight Problems

1. If a post 5 ft. high casts a shadow of 4 ft., how high is a tree whose shadow is 40 ft. ?

2. Find the cost of 7 pounds of sugar at the rate of 19 cents for 3½ pounds.

3. At 3 for 5 cents, how much will be paid for 36 oranges ?

4. If a baseball club wins 4 games out of every 7 played, how many games will they win out of 70 ?

5. The election returns continue to show a majority for A of about 317 in every 100 districts ; about how great a majority should he receive in a state containing 1000 districts ?

6. If there are rations sufficient to last 1000 soldiers for 64 days, how long should they last 2000 soldiers ?

7. When it requires 80 men to do a piece of work in 17 days, how many men would it take to do the work in 34 days ?

8. When 4.5 yd. cloth cost $11, how many yards can be bought for $44 at the same rate ?

9. If the interest on $200 for a year is $12, what is the interest for a year on $ 600?

10. What will be the cost of 39 baskets at the rate of $3 for a " baker's dozen," thirteen baskets ?

11. If 64 horses eat 84 bushels of oats per week, how many horses will eat 21 bushels (*a*) in a week ? (*b*) In 2 weeks ?

12. In order to make his stock of hay last 8 weeks, a farmer sells 6 cows. If he kept all his cows, the hay would have lasted only 4 weeks. How many cows did he have originally ?

Written Problems

1. When a fence 6 ft. high casts a shadow of $4\frac{1}{2}$ ft., how high is a tree whose shadow at the same time is $31\frac{1}{2}$ ft. in length?

2. What is the cost of $24\frac{1}{2}$ pounds at the rate of 19 ¢ for $3\frac{1}{2}$ pounds?

3. At the rate of 50 ¢ for 13 boxes of sardines, what would be paid for $6\frac{1}{4}$ doz. boxes?

4. If a baseball club wins 51 games out of 96 played, how many victories would there be in 32 games at the same rate?

5. A's majority in 342 districts is 273. What will be the majority in 1140 districts if the rate continues the same?

6. If there are rations for 1500 soldiers for 9 weeks, how many days will they last if the garrison is increased by 600 men?

NOTE. — How many men would there be in the increased garrison?

7. When 81 men are required to do a piece of work in 32 days (*a*) how many men are needed to do it in 24 days? (*b*) How many additional men?

8. How many yards of cloth can be bought for $47 at the rate of $11.75 for $3\frac{3}{4}$ yards?

9. If the amount of $250 for a year is $265, what is the amount of $250 for 2 years? What is the interest for 1 yr.? For 2 yr.?

10. Find the cost of 39 doz. baskets at the rate of $3.75 for 13 baskets.

11. What fraction of his cows must a farmer sell to make his stock of feed last $1\frac{1}{8}$ times as long as it would if he kept them all?

Business Forms

Copy the following letters, etc. :

1.
24 RAILROAD AV.
MARICOPA, ARIZ.
July 11, 1916

MESSRS. DENNIS & POLAND
41 Park Row
Tucson, Ariz.

Gentlemen
Kindly deliver at your earliest convenience the following articles se-
lected by Mrs. Nostrand last week:

1 Roll Axminster Carpet
1/2 doz. Oak Chairs
2 Rockers
4 Brussels Rugs
1 Dining Table

Send bill at once, making the usual cash discount, and I will mail
check immediately.
Yours

GEO. E. NOSTRAND

2.

Messrs. Dennis & Poland
41 Park Row
Tucson
Arizona

STAMP

3. 41 PARK ROW
TUCSON, ARIZ.
July 12, 1916

GEORGE E. NOSTRAND, ESQ.
24 Railroad Av.
Maricopa, Ariz.

Dear Sir
Yours of the 11th inst. is at hand. The order has received our best
attention, and the goods will be delivered to-day.
Please find bill inclosed, discounted as you request.
Awaiting your further orders, we are

Yours respectfully

DENNIS & POLAND

A letter should contain the address of the sender and
the address of the person to whom it is sent.

4. TUCSON, ARIZ., July 12, 1916

MRS. GEO. E. NOSTRAND
24 Railroad Av.
Maricopa, Ariz.

Bought of DENNIS & POLAND

FURNITURE, CARPETS, ETC.

41 Park Row

36 yd. Carpet	*$ 1.50*	*54*	—		
½ doz. Chairs	*18.—*	*9*	—		
2 Mahogany Rockers	*6.25*	*12*	*50*		
4 Brussels Rugs	*2.50*	*10*	—		
1 Dining Table		*45*	—		
		130	*50*		
Less 10 %		*13*	*05*		
				$117	*45*

Business Forms

5.   24 RAILROAD AV.
                                              MARICOPA, ARIZ.
                                                  July 13, 1916

MESSRS. DENNIS & POLAND
            41 Park Row
                        Tucson, Ariz.

Gentlemen
    Inclosed please find check for One Hundred Seventeen and 45/100
Dollars, in settlement of accompanying bill.
    Kindly receipt the latter and return it to
                                    Yours truly \
                                  GEO. E. NOSTRAND

6. Check :

No. *863*   MARICOPA, ARIZ., *July 13,* 1916

THE FARMERS AND DROVERS NATIONAL BANK

Pay to the order of   *Dennis & Poland*

_____*One Hundred Seventeen*_____$\frac{45}{100}$ DOLLARS.

$117 $\frac{45}{100}$ *George E. Nostrand*

---

7.   41 PARK ROW
                                              TUCSON, ARIZ.
                                                  July 14, 1916

GEORGE E. NOSTRAND, ESQ.
            24 Railroad Av.
                        Maricopa, Ariz.

Dear Sir
    Your favor of the 13th inst., with accompanying check, is at hand.
We return receipted bill herewith.
    Trusting that the goods will prove satisfactory, we remain
                                    Yours sincerely
                                  DENNIS & POLAND

Written Exercises

1. Make out bills for the following purchases supplying names, dates, etc. :

(*a*) 32 yd. Pongee at $ .25
      2 Sweaters at $3.50
      ½ doz. Collars at $1.50
      3 pr. Blankets at $2.75
          less 5 %

(*b*) ½ doz. Spoons at $4.50
      2 Carvers at $0.75
      1½ doz. Knives $1.50
      3 Salt Cellars at $0.28
          less 10 %

2. Make out a check for $15 as a payment of part of bill (*a*), dated the day after the purchase. Use the name of a local bank.

3. Give credit on bill (*a*) for the amount of the check, with the date.

4. Make out a receipt on account for the amount of the check.

5. Write a check for the balance of bill (*a*), dated a week later than the first check.

6. Receipt bill (*a*).

7. Make out a receipt for the amount of the check sent in settlement of bill (*a*).

8. Make out a check for bill (*b*).

9. Write a receipt in full for this amount.

10. Receipt bill (*b*).

11. Make out the bill of a mechanic for materials furnished and 3 days' work at prevailing rates.

12. Write a letter ordering the goods in (*a*) or (*b*).

13. Address the envelope for the foregoing letter, following the form on page 238, writing the name of the state without abbreviation.

The Day Book

In the *day book* kept by Madden & Bristol, all transactions with customers having accounts, are entered as they occur. Ordinary petty sales for cash are omitted, the total of these being kept by means of the cash register, etc.

The following are extracts from pages of Madden & Bristol's day book:

		September 27, 1916	*Dr.*		*Cr.*	
169	*Cornelius Watson, Cr.*					
	By *24 lb. Butter* *.27* *6.48*					
	" *6 doz. Eggs* *.18½* *1.11*				7	59
	"					
45	*Alexander S. Ferris, Dr.*					
	To *5 bbl. Flour* *5.75*		28	75		
	—— *28* ——					
169	*Cornelius Watson, Dr.*					
	To *Cash*		20	—		
	—— *29* ——					
213	*James E. Sullivan, Dr.*					
	To *48 lb. Butter* *.30*		14	40		
	"					
169	*Cornelius Watson, Dr.*					
	To *100 lb. Coffee .28* *28.—*					
	150 " Sugar .06 *9.—*					
	15 " Tea .40 *6.—*					
	4 yd. Mull .29½ *1.18*		44	18		
	—— *30* ——					
25	*M. Mullaly*					
	By *100 bbl. Flour* *5.40*				540	—

At a convenient time the bookkeeper "posts" the foregoing accounts in the ledger, writing the ledger page in the first column to show that the account is posted.

The Ledger

Cornelius Watson, a farmer, makes purchases from Madden & Bristol, and supplies them with farm produce. When he calls to settle his account, the bookkeeper refers to page 169 of the *ledger*, which shows the following entries, posted from the day book:

Dr.					CORNELIUS WATSON			Cr.	
1916					1916				
Sept.	7	To Mdse	18	63	Sept.	8	By Mdse	24	80
	14	" "	24	59		10	" "	6	45
	21	" "	32	49		11	" "	5	60
	28	" Cash	20	—		15	" "	12	30
	29	" Mdse	44	18		18	" "	32	—
						27	" "	7	59
						30	" Balance	51	15
			139	89				139	89
Oct.	1	To Balance	51	15	Oct.	2	By Cash	20	—
							" Mdse	15	40

In addition to the accounts of persons to whom Madden & Bristol sell goods and from whom they make purchases, their ledger contains a Cash account, in which are entered all receipts and disbursements of money; a Merchandise account; an Expense account, in which are entered payments for rent, clerk hire, etc.; an account with *themselves*, from which they obtain a knowledge of the condition of their business as to its profit or loss.

The farmer that desires to know the profits realized from various sources, keeps a crop account, a dairy account, a poultry account, etc.

Sometimes he keeps a day book, in which he enters the number of hours of work done on the different crops, purchases, sales, etc.

Written Exercises

1. Make out the bill of Madden & Bristol for the goods puchased by Cornelius Watson on Sept. 30.

2. Copy the following monthly statement rendered by Madden & Bristol, Sept. 29, 1916.

<div align="center">

MONTHLY STATEMENT

MISSOULA, NEB., Sept. 30, 1916

MR. CORNELIUS WATSON

IN ACCOUNT WITH MADDEN & BRISTOL

GENERAL MERCHANDISE

</div>

1914		Dr.				
Sept.	7	To Bill rendered	18	63		
	14	" " "	24	59		
	21	" " "	32	49		
	28	" Cash	20	—		
	29	" Bill rendered	44	18	139	89
		Cr.				
Sept.	8	By Mdse	24	80		
	10	" "	6	45		
	11	" "	5	60		
	15	" "	12	30		
	18	" "	32	—		
	27	" "	7	59	88	74
Sept.	30	Due us			$ 51	15

In the monthly statement are omitted the details of goods delivered and received, especially when a bill has been rendered at the time of each purchase, or a slip given.

3. Make out the account of Madden & Bristol as it would appear in the ledger kept by Cornelius Watson.

In this the items appearing as credits in the ledger of Madden & Bristol would be entered on the debit side of Mr. Watson's ledger, and *vice versa*.

4. Make out a monthly statement rendered by Mr. Watson, Sept. 30.

5. Calculate the profit shown by the following account.

Dr.   *Field No. 1 — 20 Acres Potatoes*   *Cr.*

Mar.	15	*Seed, 80 bags*	*$ 4.50*			*Sept.*	16	*2400 bu.*	*.75*	
Apr.	20	*Fertilizer, 15 T.*	*25.00*				25	*1250 "*	*.77*	
		Spraying, 20 A.	*6.00*				30	*900 "*	*.78*	
		Labor, 180 da.	*1.50*			*used*		*57 "*	*.75*	
		Horse, 260 "	*.75*			*Oct.*	15	*300 "*	*.80*	
		Rent, 20 A.	*5.00*							
Oct.	15	*Net Profit*								

6. A farmer received $1344.72 from a 13-acre field of potatoes. Find the balance after deducting expenses as follows :

$9\frac{3}{4}$ tons of Fertilizer @ $35
$\frac{1}{10}$ ton of Plaster @ $10
37 bbl. Seed Potatoes @ $3
7 bbl. Seed Potatoes @ $2.75
28 lb. Paris Green @ $.22
Labor (man) 125 days @ $1.25
Labor (horse) 140 days @ $.75

7. (*a*) How much butter is made from 3360 pounds of fat, if the weight of the latter is increased $\frac{1}{6}$ by the water and salt contained in the butter ? How many pounds of milk (*b*) containing $3\frac{1}{6}\%$ of fat will yield the foregoing quantity ? (*c*) Containing $5\frac{1}{4}\%$ of fat ?
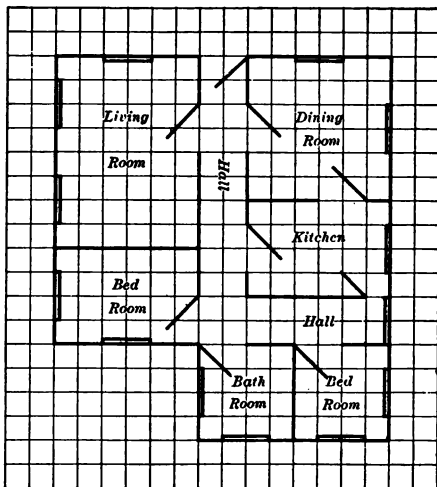
8. (*a*) If it costs a farmer 35¢ per ton per mile, what does it cost him to deliver 1400 bushels of wheat to a railroad station 4 miles from the farm ? (*b*) What will he save on 1400 bushels when the cost is reduced to 20¢ per ton per mile by the improvement of the roads ?

SECTION VI

MEASUREMENTS, PERCENTAGE APPLICATIONS, INTEREST, BANK DISCOUNT, REVIEWS

Planning a House

Mr. Kirby wishes to build a 6-room house for a summer residence. He makes the following diagram of the floor, using cross-ruled paper, the distance between the lines representing 2 feet. The location of the windows is shown by double lines.

Oral Exercises

1. What are the dimensions of the floor of (*a*) the living room? (*b*) The dining room? (*c*) The kitchen? (*d*) The bathroom? (*e*) The large bedroom? (*f*) The small bedroom?

2. Give the area of the floor of each room.

3. (*a*) What is the width of the hall? How long is (*b*) the front hall? (*c*) The side hall?

4. If the outer walls are 1 foot thick and the inner ones (the partitions) 6 inches thick, what is (*a*) the extreme width of the house? (*b*) Its greatest depth?

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Drawing to Scale

Written Exercises

**1.** Draw the floor plan showing the thickness of the walls and of the partitions.   Indicate the location of a window by the omission of the shading and that of a door by leaving the proper opening, using an oblique line to denote the direction in which the door opens.   Insert chimneys and closets where you think they are needed.
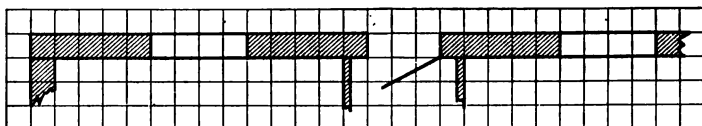
If cross-ruled paper is used, represent 1 foot by the distance between the lines.

2. On a larger scale draw the floor plan of the kitchen locating the chimney, the stove (or range), the sink, and one or two closets.

Base Board
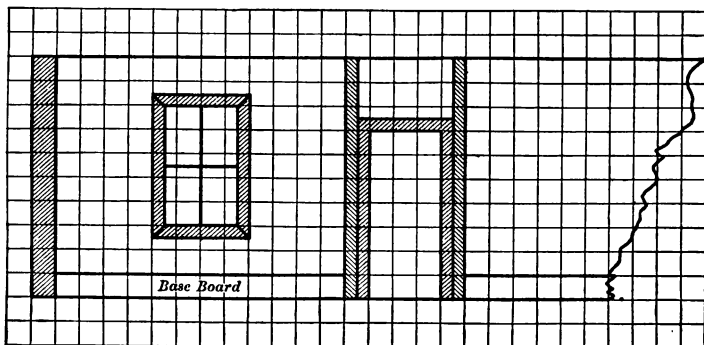
3. Copy and complete the above portion of the front elevation of the interior, showing the thickness of the walls and of the partitions, the location of the windows and of the door.   Show the paneling of the door.

Furnishing the House

Written Exercises

After building the house Mr. Kirby has $600 to spare for the equipment. Mrs. Kirby apportions $560 of this sum as shown below, retaining $40 for emergencies. Make out a list of the articles she can purchase with this money. The following items are suggested. Supply omissions, and insert the cost of each article.

1.   *The Living Room* $100

Book case	Rocker	Window shades
Desk	Arm rocker	Curtain hooks
Desk chair	Rug	Curtain poles
Center table	Curtains	Shades
Pictures	Sofa	Chairs
Clock	Stove	Books
Phonograph	Records	Sundries

2.   *The Dining Room* $160

Buffet	Pictures	Cutlery
China closet	Rug	Spoons, etc.
Extension table	Window shades	Water jug
Serving table	Curtains	Tumblers
2 Arm chairs	Rods and hooks	Cruets
4 Chairs	Dinner set	Flower vase
Stove	Clock	Napkins
Tray	Call bell	Sundries

3.   *The Kitchen* $110

Stove	Chairs	Glassware
Table	Clock	Tinware
Shade	Linoleum	Dishes
Picture	Towels	Freezer
Refrigerator	Bread box	Sundries

4.   *Bedroom* $100

Dresser	Large Bed	Pillows
Chiffonier	Spring	Blankets
Rocker	Mattress	Spread
Comforter	Sheets	Pillow slips
Shades	Curtains	Lounge
Chairs	Rod and Hooks	Matting
Rugs	Pictures	Sundries

5.   *Bedroom* $50

2 Beds (single)	Springs	Pillows
Dresser	Mattresses	Blankets
Rocker	Sheets	Spreads
Chairs	Curtains	Pillow slips
Shades	Rod and hooks	Matting
Rugs	Pictures	Sundries

6.   *The Bathroom* $20

| Medicine chest | Mirror | Towels |
| Toilet articles | Bath rug | Sundries |

7.   *The Halls* $20

| Hat rack | Mat | Towels |
| Picture | Table | Sundries |

8. Using a convenient scale, draw a rectangle representing $100' \times 150'$. Draw the outline of the house as nearly as possible in the center of the plot.

9. Draw an elevation of the front wall of the classroom, locating the baseboard, the doors, the blackboard, etc.

10. Make a scale drawing of the school lot, and locate on it the building.

11. Taking the surface of each window as $5' \times 3'$, compare the window space of each room with its floor space.

Some Household Problems

Written

1. A 2-gallon pail of water with the vessel weighs 20 pounds. (*a*) When 10 pails are used 3 times a day for meals and 20 pails for other purposes, how many pounds must be handled to bring the water into the house, and (*b*) how many to carry it out again? (*c*) Carrying one pail at a time, how far must a person travel in bringing it from a well 40 feet from the kitchen and disposing of the waste water in a drain 30 feet distant?

2. (*a*) What is the cost of bringing water into a farm-house at a cost of $25 for a pump, $40 for a gasoline engine, $20 for a tank, $42 for bathroom equipment, $4 for an extra basin, 8¢ per foot for 500 feet of pipe, $15 for a kitchen sink, $4 for valves, $60 for labor, etc.? (*b*) At 6%, what is the yearly interest on the cost? (*c*) How much less than 5¢ is the daily interest at 7%?

3. A pupil in a millinery class used for her hat 4 yards of ribbon at 45¢, 6 bunches of flowers at 85¢, and 16 yards of straw braid at 12½¢. (*a*) How much did the material cost? (*b*) What would be the cost of the hat at a store, if the milliner charged $3.50 for making, and added 40% to the cost of the materials? (*c*) What did the girl save by doing the work in her spare time?

4. Each pupil in a sewing class made a white skirt containing 1¼ yd. cambric @ 12½¢, 2¾ yd. embroidery @ 10¢, 1 piece feather trimming @ 10¢. (*a*) Find the cost of the material for each, including 3 papers of pins @ 24¢ per dozen, 1½ doz. spools of cotton @ 38¢ per dozen, and 200 needles @ 10½¢ per 100, used in making 4 doz. skirts. (*b*) How much would the manufacturer

charge per dozen, if he added 25% for labor and profit? (*c*) What would be the price in a store if $33\frac{1}{3}$% were added to the manufacturer's price?

5. The class also made 50 Marguerites, each containing $2\frac{1}{4}$ yd. nainsook @ 15¢, 4 yd. lace trimming at 6¢, $1\frac{1}{2}$ yd. ribbon @ 2¢. Find the cost per dress including pins, needles, cotton, etc., as given in problem 4.

6. What does a girl average per week if she receives $27 per week for 17 weeks, $17 per week for 13 weeks, and is idle 22 weeks?

7. The goods in a suit cost $1.05, and the buttons, etc., 15¢. The cost of the labor was 50% of that of the material. The manufacturer's expenses added 50% to the price of the labor and material. (*a*) What was the cost to the manufacturer? (*b*) If he sold a suit at an advance of 50%, what did he receive for it?

8. A man, who has saved $400, borrows $600 from a loan association and buys a house for $1000. His taxes are $10 per year and he spends $20 per year for repairs. (*a*) How much does he spend in six years including $10 per month to the association? (*b*) If the monthly payments pay off the loan in six years, how much will he have paid as interest?

9. A boy earned $8 per week during his first 26 weeks in business and put 50 cents in bank each week. He then received an increase of 25% in wages and increased his deposits 30%. How much had he in bank at the end of the year?

10. A girl earning $8 per week, contributed $3 weekly to the family support, put 25¢ per week in the bank, spent 10¢ for car fare and 15¢ for lunch for 300 days. How much had she for clothing, etc., for the year?

Lines and Angles

The lines AB and XY, which will not meet no matter how far they are prolonged, are said to be parallel.

The lines BA and CA which meet at A, form an *angle*.
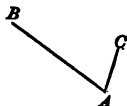
The line HI forms two angles at I with the line KJ. When these are unequal, each is called an *oblique* angle; when they are equal, as at N, each is called a *right* angle, and MN is said to be *perpendicular to OP.*

An angle smaller than a right angle HIK, for instance, is called an *acute* (sharp) angle; one larger than a right angle HIJ, for instance, an *obtuse* (blunt) angle.
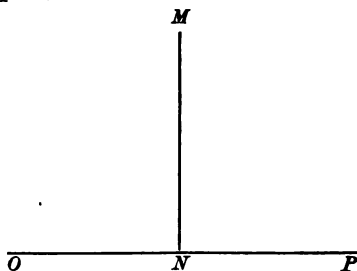
Angles of a Parallelogram
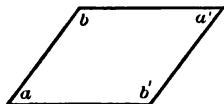
RECTANGLE   RHOMBOIDS

A parallelogram containing four right angles is called a *rectangle;* one containing four oblique angles is called a *rhomboid.* The opposite angles of a rhomboid are equal; a and a', b and b'. Two of them are acute and two are obtuse.

Areas of Rhomboids

Preparatory Exercise

From a strip of paper 4 inches wide cut several rhomboids, having bases measuring 6 inches each. Show that each is equivalent in area to a rectangle 6 in. by 4 in.
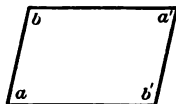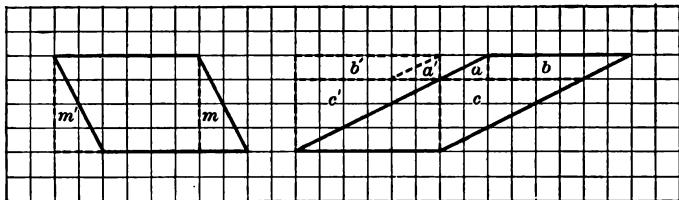

FIG. 1   FIG. 2

SUGGESTION. — Cut off triangle *m*, and place at *m'*. Cut off *a*, *b*, and *c*; and place at *a'*, *b'*, and *c'*.

Sight Exercises

1. What is the perpendicular distance between the bases?

2. If the rhomboid shown in Fig. 1 is divided into two triangles by a diagonal ending in the lower right corner, (*a*) what is the area of each? How long is (*b*) the base of each? (*c*) The perpendicular?

A triangle having all of its angles acute is called an *acute-angled* triangle; one containing an obtuse angle, is called an *obtuse-angled* triangle.

3. (*a*) In what direction must a diagonal be drawn to divide the rhomboid shown in Fig 1 into two obtuse-angled triangles? (*b*) Taking the lower horizontal side of the rhomboid as the base of one triangle, what line measures the perpendicular? (*c*) Does this line lie within the triangle?

The Trapezoid

A quadrilateral that has only two parallel sides is called a *trapezoid*.
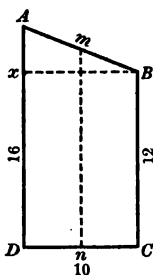
1. $ABCD$ represents one end of a shed 16' high in the front, 12' high in the back, and 10' deep. Draw Bx parallel to DC. (*a*) What are the dimensions of the rectangle $xBCD$? (*b*) Its area? (*c*) What are the dimensions of the right triangle ABx? (*d*) Its area? (*e*) What is the area of the end of the shed? (*f*) What is the average height, mn?

2. $EFGH$ represents a tapering sheet of tin, 16 inches long at the bottom, 12 at the top, and 10 inches wide. (*a*) What is the area of the rectangle $EFmn$? (*b*) Of the right triangle EmH? (*c*) Of EnG? (*d*) Of $EFGH$? (*e*) What is the length of op, the average width of the strip?
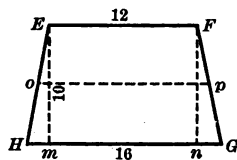
Areas of Trapezoids

3. From paper 6 in. wide cut several trapezoids, each having an upper base of 2 in. and a lower base of 6 in. Show that each is equivalent to a rectangle 6 in. by 4 in.
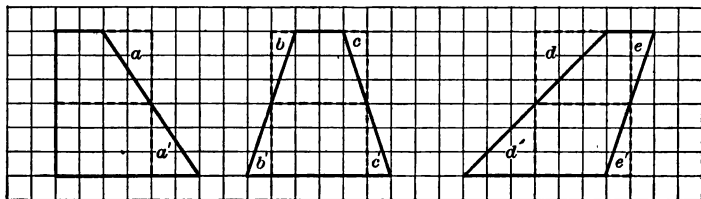
Cut off triangle a' and place at a, cut off b', and place at b, etc.

Sight Exercises

1. (*a*) What is the perpendicular distance between the parallel sides of each trapezoid? (*b*) What is the half sum of the parallel sides?

2. What are the dimensions (*a*) of *a* and *a'*? (*b*) Of *b* and *b'*? (*c*) Of *c* and *c'*? (*d*) Of *d* and *d'*? (*e*) Of *e* and *e'*? (See diagram on p. 254.)

Area of trapezoid = ½ *Sum of parallel sides* × *Perpendicular distance between them.*

---

3. Find the number of square feet in the side of a hen house 7' high in front, 5' in the back, and 12' long.

4. A tapering board is 6'' wide at one end, 12'' wide at the other, and 16' long. How many square feet are there in its surface?

5. Find the areas of the following trapezoids:

(*a*) Parallel sides 20 yd. and 30 yd. Perpendicular 16 yd.

(*b*) Parallel sides 40 rd. and 50 rd. Perpendicular 33⅓ rd.

(*c*) Parallel sides 10 in. and 15 in. Perpendicular 24 in.

(*d*) Parallel sides 30 ft. and 50 ft. Perpendicular 20 ft.

(*e*) Parallel sides 30 yd. and 42 yd. Perpendicular 16⅔ yd.

A quadrilateral having no parallel sides is called a *trapezium*.

Polygons

A plane figure bounded by straight lines is a *polygon*.

A polygon having five sides is called a *pentagon*, one having six sides a *hexagon*, one having eight sides an *octagon*, etc.

Written Exercises
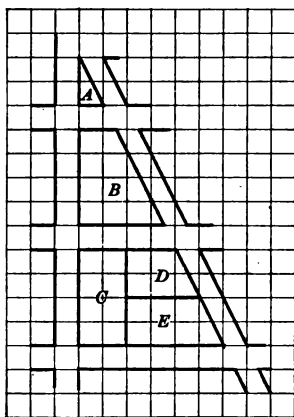
The accompanying diagram is drawn on a scale of 400 feet to the inch.

1. (*a*) What are the dimensions of block *A*? (*b*) What is its area?

2. (*a*) What are the respective lengths of the parallel sides of block *B*? (*b*) What is the perpendicular distance between them? (*c*) What is the area of the block?

3. What is the perpendicular distance between the parallel sides (*a*) of plot *D*? (*b*) Of plot *E*? (*c*) Of the entire block?

4. Find the area (*a*) of the block. (*b*) Of plot *C*. (*c*) Of plot *D*. (*d*) Of plot *E*.

5. (*a*) Find the number of square rods in the plot *FGHI* when *IG* measures 24 rods, *Fx* 15 rods, and *yH* 9 rods. (*b*) What is the area in acres and a decimal?
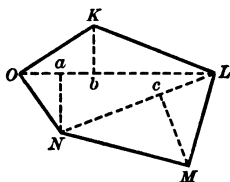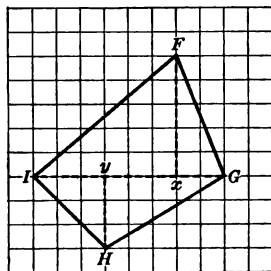
6. To determine the area of the 5-sided field *KLMNO*, the following lines are measured : *OL*, 28 rods ; *NL*, 24 rods ; *Kb*, 8 rods ; *Na*, 10 rods ; and *Mc*, 12 rods. How many square rods are there in the field?

Board Measure

Preparatory Exercises

The back of a henhouse is 12 ft. long and 12 ft. high.

1. How many square feet are there in its surface?

2. How many boards, each 12 ft. long, will be required when the boards are (*a*) 12 inches wide? (*b*) 6 inches wide? (*c*) 8 inches wide?

3. How many square feet will be covered by a board (*a*) 12 ft. long, 12 in. wide? (*b*) 12 ft. long, 8 in. wide? (*c*) 12 ft. long, 6 in. wide?

Lumber is sold by the *board foot*, which means a piece of wood 1 foot long, 1 foot wide, and 1 inch thick. A piece 1 foot long, 1 foot wide, and 2 inches thick contains 2 board feet. Boards less than 1 inch thick are assumed to have a thickness of an inch.

> *To find the number of board feet in a piece of lumber multiply the number of feet in its length by the number of feet in its width by the number of inches in its thickness.*

Sight Exercises

Give the number of feet in each of the following boards, planks, joists, etc., measuring as follows:

1. $16' \times 6'' \times 3''$ $(16 \times \frac{1}{2} \times 3)$

2. $10' \times 12'' \times 2''$ $(10 \times 1 \times 2)$

3. $18' \times 8'' \times 4''$ $(18 \times \frac{2}{3} \times 4)$

4. $16' \times 12'' \times \frac{7}{8}''$ $(16 \times 1 \times 1)$

5. $12' \times 8'' \times 6''$ **6.** $12' \times 6'' \times 8''$

7. $14' \times 6'' \times 2''$ **8.** $16' \times 6'' \times 3''$

9. $12' \times 6'' \times 3''$ **10.** $12' \times 4'' \times 4''$

Industrial Applications

Sight Problems

1. When a carpet is 27 inches wide (*a*) what is its width in feet and inches? (*b*) In feet and a fraction? (*c*) In the fraction of a yard?

2. If it required 8 strips of carpet $2\frac{1}{4}$ ft. wide to cover the floor of a square room, (*a*) how wide is the room? (*b*) What is the length in feet? (*c*) In yards? (*d*) How many yards long is each strip?

3. When a grass plot is 30 yards square and a mowing machine cuts a strip $\frac{3}{4}$ yard wide (*a*) how many such strips will there be in the plot? (*b*) How long is each strip? (*c*) How far would a boy walk in mowing 1 strip? (*d*) Excluding the distance required to make the turns, how many feet would a boy travel in mowing 40 strips?

4. If a plow turns a strip (furrow) $1\frac{1}{2}$ feet wide, (*a*) how many such strips will there be in a field 1500 feet square? (*b*) How long is each strip (furrow)?

5. If a mowing machine cuts a strip $4\frac{1}{2}$ ft. wide, how many such strips will there be (*a*) in a field 900 feet wide? (*b*) In a field 300 yards wide?

6. If a floor is 8 yards long, 6 yards wide, (*a*) which way can a carpet be laid to cover the floor without splitting a strip when the carpet is $\frac{3}{4}$ yard wide? (*b*) How many strips will be required? (*c*) How long is each strip? (*d*) How many yards of carpet will it take?

7. How many square feet are there in a furrow $1\frac{1}{2}$ ft. wide, 6000 ft. long?

8. How many feet long must a furrow be to contain 9000 sq. ft. when it is $1\frac{1}{2}$ ft. wide?

9. How many feet are there in a strip 2000 ft. long and 4½ ft. wide?

10. How many feet long must a strip be to contain 18,000 sq. ft., when the strip is 4½ ft. wide?

11. How wide must a strip be in order that 2000 ft. of the strip will contain 9000 sq. ft.?

12. If a boy mows a plot 30 feet square by cutting strips forward and backward, how many times does he turn at the ends when the machine cuts a 30-inch strip?

13. Since 10 cubic feet of water became 11 cubic feet of ice, (*a*) how many cubic feet of ice will 30 cubic feet of water make? (*b*) How many cubic feet of water will result from the melting of 88 cubic feet of ice?

14. A cubic foot of water weighs 1000 ounces; what does a cubic foot of ice weigh?

15. If 6 men can plow a field in 4 days, how long will it require 8 men to do it?

16. When ⅔ of a ship is worth $4000, what is ⅚ of it worth?

17. If a captain has food enough to last his crew of 10 people for 4 days, how long would it last 8 people?

18. If there are provisions for 10 men for four days, how much longer would they last if there were 2 men fewer?

19. A plank contains 27 board feet. It is 1 in. thick and 18 in. wide. How long is it?

20. If a boy spends 1¾ hours per night in study, how many minutes does he study in 5 nights?

21. How many more half hours are there in January than in June?

22. How many days are there from May 15 to June 15?

23. At 50 cents per hour, how much does a man receive in a week if he works 5 hours on Saturday and 8 hours each of the other five days?

24. How many half pint glasses of lemonade are there in 7½ gallons?

25. What is the cost of a cubic yard of stone at 8 ¢ per cu. ft.?

26. When a shingle covers 4″ × 4″, how many shingles will cover a square foot?

27. What fraction (*a*) of a shingle 16″ long is covered by the upper layers when 4″ is exposed? (*b*) Of a shingle 18″ long?

28. A barrel of lime containing 2½ bu. costs $1.05. What is the price per bushel?

29. A barrel containing potatoes weighs 170 lb., the barrel itself weighs 20 lb. At 60 lb. to the bushel, how many bushels of potatoes are in the barrel?

30. How many cubic feet of concrete are there in a sidewalk 200 ft. long, 6 ft. wide, when the concrete is 4 in. thick?

31. At 75 ¢ per load, how many loads of sand will cost $39?

32. How many square yards are there in the ceiling of a room 30 ft. long, 24 ft. wide?

33. How many square yards are there in the walls of a room 30 ft. long, 24 ft. wide, 9 ft. high?

34. How many yards of carpet ¾ yard wide will contain 60 square yards?

35. At 75 ¢ per square yard what will be the cost of plastering the walls and the ceiling of a room containing 160 sq. yd.?

Written Problems

1. How many cubic feet of ice are contained in a rectangular pond 880 ft. long, 300 ft. wide, when the ice is 16 inches thick?

2. Since 10 cubic feet of water are increased by freezing to 11 cubic feet of ice, how many cubic feet of water will make a pile of ice measuring 880 ft. by 300 ft. by $1\frac{1}{5}$ ft.?

3. At the rate of 11 cubic feet of ice to 62.5 lb., find the weight in tons of the ice in a rectangular pond 880 ft. by 300 ft., when the ice is 16 inches thick.

4. If ice 16 inches thick on a pond 880 feet long, 300 feet wide is placed in a pile 100 ft. long, 88 ft. wide, how high will the pile be?

$$\text{Height in feet} = \frac{1\frac{1}{3} \times 880 \times 300}{100 \times 88}.$$

5. If $\frac{11}{16}$ of a schooner is worth $13,200, what is the value of $\frac{5}{8}$ (10 sixteenths) of it?

6. A commander has sufficient provisions to last his 1200 men 27 days. (*a*) How many men could he keep for 30 days? (*b*) How many of his 1200 men must he send away in order that he may have sufficient food to last 3 days longer than the original 27 days?

7. A rectangular field contains 27 acres. It is 96 rods long. How wide is it?

$$27 \times 160 \div 96.$$

8. If a boy spends $1\frac{3}{4}$ hours per night in study for 5 nights per week, in how many weeks will he have spent 105 hours in study?

9. How many half days are there from May 15 to Dec. 24?

10. At 8¢ per cubic foot what will be the cost of the stone required to build a wall 66 ft. long, 6 ft. high, 1½ ft. thick, if the stone is $\frac{11}{12}$ of the wall?

11. At 16½ cu. ft. to the ton, how many tons of stone will be required for a wall 4 rd. (66 ft.) long, 2 yd. (6 ft.) high, 18 in. (1½ ft.) thick, when $\frac{1}{12}$ is deducted for the space occupied by the mortar?

Indicate operations. Cancel.

12. At 50 cents per hour how much does a man earn in 365 days, working 5 hours on each of 52 Saturdays and 8 hours on the remaining days excluding 52 Sundays and 5 holidays?

13. How much surface will be covered by 1000 cypress shingles each 18 in. long, 4 in. wide, if only ¼ of the length of each shingle is exposed, the remainder being covered by the shingles above it?

14. Make out a bill for the construction of a wall, the cost of materials and labor being as follows:

        16¼ cu. ft. stone @ 8¢
           ¾ bu. lime   @ 42¢
           ⅕ load sand   @ 75¢
           Mason 2⅝ hr. @ $4.80 per day of 8 hours.
           Helper 1¾ hr. @ $1.60 per day of 8 hours.

15. If a broker's commission for selling cotton is $5 per 100 bales of 500 pounds each, what fraction of the price does he receive when cotton is selling at 12½¢ per pound?

16. A coffee broker is paid $10 for selling 250 bags of coffee weighing 130 pounds each. What fraction of the price does he receive when coffee is selling for 6½¢ per pound?

17. In 15 days 51 men receive a certain sum in wages. How many men will earn the same sum in 17 days?

18. If I lend a man $180 for 3 months, how long should he lend me $120 in return?

19. In a library there were 3600 volumes last year. This year there are 3750. What per cent is the increase?

20. (*a*) When a man's wages are increased from $900 to $1350 per year, what is (*a*) the fraction of increase? (*b*) The per cent? (*c*) If the wages fell off from $1350 to $900, what would be the fraction of decrease? (*d*) The per cent?

21. A blackboard contains 2 square yards. It is $4\frac{1}{2}$ ft. long. How wide is it?

22. A can do $\frac{1}{10}$ of a piece of work in a day, B can do $\frac{1}{12}$ of it in a day, and C can do $\frac{1}{15}$ of it in a day? What part of it can all three together do in a day? How long would it take the three together to do the work?

23. At 21 bricks to the cubic foot, find (*a*) the number of bricks required for a wall 50 ft. long, 40 ft. high, 12 in. thick. (*b*) Find the cost of the bricks at $8 per M.

24. (*a*) How many square feet are there in the front of a house 25 feet wide, 40 feet high, deducting for 1 door $8' \times 3'$ and 8 windows, each $6' \times 3'$? (*b*) For how many square yards would a painter charge if he allowed only one half the space occupied by the door, windows, etc.?

25. How many boxes of glass, each containing 50 sq. ft., are required for 10 windows, each $6'$ by $3'$, if 12 in. are deducted from each dimension for the space taken by the frames, sashes, etc.?

26. (*a*) How many double rolls of paper 16 yd. long, 18 in. wide would be required for a wall 24 ft. long, 9 ft. high? (*b*) What would be the cost of hanging the paper at 15 cents per single roll?

Some Applications of Percentage — Commission

A person that buys or sells or collects money for another is called an *agent*, and the fee received for his services is called his *commission*. The commission is frequently a certain percentage of the sum involved.

A person that buys land, grain, etc., for another is frequently called a *broker* and his commission is sometimes called *brokerage*. An agent that sells produce for a farmer is called a *commission merchant*.

Sight Problems

1. What does an agent receive for collecting a debt of $450, when his rate of commission is 2 % ?

2. A real estate agent sells a house for $5000. What is his commission at 5 % on $1000 and $2\frac{1}{2}$ % on the remainder ?

3. A broker buys 1000 barrels of flour at $6 for which he receives a commission of $\frac{1}{8}$ of 1 %. What is his commission on the purchase ?

4. If an agent deducts $2\frac{1}{2}$ % commission for collecting a debt of $600, what sum does he remit to his employer ?

5. Find the commission at 2 % for selling 100 cases of eggs of 30 doz. each, which brought 20 cents a dozen.

6. The gross proceeds of a sale of berries were $500. The deductions are 4 % commission and $10 charges. Give the net proceeds that are remitted to the shipper.

7. What brokerage is charged for buying 120 shares of stock, $100 each, at $\frac{1}{8}$ % ?

8. What does an agent receive for collecting 75 % of a debt of $400, at 2 % commission ?

Written Exercises

1. Copy and complete the following statement rendered by a commission merchant to a farmer who shipped goods to be sold on commission:

ROCHESTER, WIS., May 15, 1916

MR. JOHN MADDEN,
    De Bruce, Wis.

In account with SEAVER BROS.
COMMISSION MERCHANTS
37 Market Square

		Cr.					
April	*6*	By 25 bu. Potatoes	.60	15	—		
	15	" 50 " "	.58				
	24	" 60 doz. Eggs	.10				
	30	" 120 bu. Potatoes	.61				
May	*8*	" 60 doz. Eggs	.11½				
	14	" 100 bu. Potatoes	.60				
		Dr.				$	(a)
April	*25*	To Freight, Cartage, etc.		(c)			
May	*15*	" Commission 5 %		(b)			
	15	" Check in full		172	94		
						$	(a)

2. Write out the check of Seaver Brothers on a Rochester Bank for the balance remitted to Mr. Madden.

3. An agent collected 75 % of a debt of $420. How much does his employer receive when the commission of 3½ % is deducted from the sum collected?

4. Find the fee received for the sale of a farm for $16,500 at the rate of 5 % on $1000, 2½ % on $4000, and 1 % on the remainder.

Taxes

The money required for the maintenance of schools, for the construction and repair of roads, for salaries of officials, etc., is obtained from the people in the form of *taxes*.

In some sections a tax of $1 or $2 is collected from every male resident. This is called a *poll* tax. Other taxes are levied on property.

A special tax, sometimes called an *assessment*, is levied upon property immediately benefited by a road, a sewer, etc., to pay the cost of its construction. A school tax is sometimes made a special tax on property lying within the school district.

The amount of taxes payable by the owner of property is based upon the value of the property as determined by public officers, called *assessors*. This *assessed value* is nearly always below the real value of the property.

The rate of taxation may be stated as a per cent of the assessed value, as so many mills per dollar, as so many dollars per $1000, etc.

Sight Exercises

1. What per cent is (a) 1 cent on the dollar? (b) 5 mills on $1? (c) 12 mills on $1?

2. What per cent is (a) $2 on $100? (b) $1.50 on $100? (c) 75¢ on $100?

3. What rate per cent is (a) $5 on $100? (b) $25 on $1000?

4. At $\frac{3}{4}$ of 1%, what are the taxes on property assessed at $1200?

5. Property worth $8000 is assessed at 75% of its value. What are the taxes at $1\frac{1}{2}$% of the assessed value?

Commercial Discount

In catalogues of their goods manufacturers and dealers affix prices much above those at which the goods are actually sold. The former are called *list*, or catalogue, prices, which are subject to a *trade discount*.

Thus an article that is " listed " by the manufacturers at $60, may be subject to a discount of 40%, which makes the price to the dealer $36. When the manufacturer determines to sell at a lower rate, he announces an additional discount, say $16\frac{3}{4}\%$, which is taken on $36, making the new rate to dealers $30.

The rates of discount are specified in a circular called a *discount sheet*, a new one being issued whenever a change in the price is made.

Whenever two successive discounts are specified, one is " based " on the list price, and the other is " based " on the price remaining after the first is deducted.

Thus in a bill of silverware listed at $600, subject to discounts of $33\frac{1}{3}$ and 10%, the discounts are taken as follows :

		$600	or			$600
Less $\frac{1}{3}$		200		Less $\frac{1}{10}$		60
		$400				$540
Less $\frac{1}{10}$		40		Less $\frac{1}{3}$		180
	Net	$360			Net	$360

it being immaterial in which order the discounts are taken. There may be any number of successive discounts.

In writing successive discounts, the per cent mark is written with only the last.

Commercial discounts include trade discount and cash discount. The latter is an allowance for payment before it is due.

Cash Discount

<div align="right">CHICAGO, ILL., Feb. 18, 1915.</div>

THE MERIDEN SILVER PLATE CO.
　　　　483-9 Lakeside Av.

<div align="center">

Sold to MR. JOHN R. THOMPSON
Marion, Ind.

</div>

Terms: 60 days, Cash 10 da. 5%.

Feb.	14	20 doz. *Spoons*　$4.50	90	—		
	16	30 " *Forks*　5.—	150	—		
			240	—		
		Less 33⅓%	80	—		
			160	—		
		Less 10 %	16	—	144	—
Feb.	15	15 *Tureens*　$8.—	120	—		
		Less 25 %	30	—		
			90	—		
		Less 15 %	13	50	76	50
					220	50
		Cash 5 %			11	02
		Recd. payment			$209	48
		Feb. 25, 1915				
		Meriden S. P. Co.				
		per J. P. M.				

By the terms of the bill, a credit of 60 days is allowed, subject to a discount of 5% if payment is made before the expiration of 10 days from the date of the bill.

The footing gives the amount due as $220.50 unless the bill is paid by Feb. 28. As it is settled on the 25th, the cash discount of 5% is deducted from the above amount.

Written Exercises

1. Make out a bill in the foregoing form for the following purchases :

30 doz. Spoons at $4.80 per dozen, less 33⅓ and 10 %.
10 doz. Knives at $5.20 per dozen, less 25 and 10 %.
24 doz. Forks at $5.40 per dozen, less 33⅓ and 10 %.
18 Plated Trays at $7.50 each, less 25 and 20 %.

Supply dates, name of buyer and of seller, and bring all the purchases within 10 days of the payment of the bill. Deduct 5 % for cash and receipt the bill.

2. Make out a check for the net amount of the bill.

3. Write out the receipt given by the seller of the goods.

4. Find the net cost of a bill of hardware amounting at list prices to $256, (*a*) with discounts of 40 and 10 % ; (*b*) with discounts of 33⅓ and 25 %.

PROCESS

(*a*)	$256.00		(*b*)	$256.
40 %	102.40		25 %	64.
	153.60			192.
10 %	15.36		33⅓ %	64.
Net	$138.24 *Ans.*			$128.00 *Ans.*

(*a*) 40% of $256 is obtained by multiplying $256 by .4, writing the first figure of the product one place to the right. 10% of $153.60 is obtained by writing the first four figures of this number, placing the first figure of the discount under the second figure of the base.

NOTE. — Successive discounts may be taken in any order.

(*b*) As 256 is a multiple of 4 and not of 3, 25 % is first deducted.

5. A dealer bought furniture listed at $400, with discounts of 20 and 10 %. He sold it for the list price. (*a*) What is his profit? (*b*) What per cent of $400 did he gain? (*c*) What per cent of the cost did he gain?

6. Find the net cost of the following :

a. $500 less 33⅓ and 10 %   *b.* $180 less 25 and 20 %
c. $600 less 40 and 10 %   *d.* $240 less 30 and 5 %
e. $700 less 30 and 20 %   *f.* $360 less 10 and 10 %
g. $800 less 50 and 30 %   *h.* $240 less 20 and 20 %
i. $900 less 40 and 40 %   *j.* $540 less 15 and 5 %

7. What is the difference between a discount of 43⅓ % on $600 and successive discounts of 33⅓ % and 10 %? Which rate is better for a buyer?

8. Find the difference between $400 less 20 and 20 %, and $400 less 30 and 10 %.

9. A quantity of hardware bought for $400 less 25 and 10 % is sold at 35 % above cost. What is the selling price?

10. A man had $10,000. By the end of the first year he had spent 10 % of it. During the second year he spent 10 % of the remainder. During each of the next two years he spent 10 % of what remained from the preceding year. (*a*) What remained at the end of the fourth year? (*b*) What did he spend in four years? (*c*) How much more did he spend in the first year than in the fourth?

11. At the end of 1915, a city had a population of 10,000. During 1916 it increased 10 %. In each of the next three years the population increased 10 % over the population of the year before. (*a*) What was the increase in four years? (*b*) What per cent was the population of 1919 greater than that of 1915?

Gain or Loss

The gain or the loss on the sale of an article is frequently expressed as a per cent of its cost.

Sight Problems

1. A grocer buys coffee at 25 ¢ per pound, and sells it at an advance of 20 %. (*a*) How many cents does he gain on each pound? (*b*) What is the selling price?

2. A dry goods merchant buys silk at $1 per yard and sells it at 80 ¢. (*a*) What is his loss per yard? (*b*) What per cent of the cost does he lose?

3. A dealer in shoes sold a pair for $2.50 on which he gained 50 ¢. (*a*) What did they cost? (*b*) What per cent of the cost is 50 ¢?

4. A dealer sells a knife for $1, on which his profit is 25 %. (*a*) What fraction of the cost is $1? (*b*) What is the cost?

5. (*a*) What per cent is lost on a horse sold for $200, which was $50 below cost?

(*b*) What per cent is gained on a horse sold for $200, which was $50 above cost?

6. (*a*) What was the cost of a cow sold for $30, if the loss was 25 % of the cost?

(*b*) What was the cost of a cow sold for $30, if the gain was 25 %?

7. (*a*) What fraction of the cost is a gain of $33\frac{1}{3}$ %? (*b*) What fraction of the selling price is a gain of $33\frac{1}{3}$ %? (*c*) What fraction of the selling price is a loss of $33\frac{1}{3}$ %?

8. If a merchant's sales are $3000 and his profits are $1000, what per cent does he gain (*a*) on the cost of the goods? (*b*) On his receipts?

9. If a man's sales are $3000 and his rate of gain is 50 %, (*a*) what fraction of $3000 is his gain ? (*b*) What per cent ?

(*c*) If a merchant's sales of damaged goods are $3000 and his rate of loss is 50 %, what per cent of $3000 is his loss ?

10. A man's pay is increased from $20 per week to $24. (*a*) By what fraction is it increased? (*b*) By what decimal ? (*c*) By what per cent ?

11. After a boy has increased his stock of marbles ¼ he has 60 marbles. How many had he originally ?

12. After a girl has given away 25 % of her cherries, she has 60 left. How many had she at first ?

13. (*a*) What number increased by ¼ of itself is equal to 15 ? (*b*) What number diminished by ¼ of itself is equal to 15 ?

14. At $8 per M, what is the cost of 12,500 bricks ?

15. Give in square feet the area of a door 7 ft. 6 in. by 2 ft. 8 in.

16. How many panes of glass 1⅔ ft. long, 1 ft. wide, will make 50 sq. ft. ?

17. At 62½ lb. to the cubic foot, how many cubic feet of water will weigh a ton ?

18. How many cubic feet are removed in digging a cellar 40 ft. long, 20 ft. wide, 10 ft. deep ?

19. If clay in carts occupies 20 % more space than it did before digging, how many cubic feet in carts will equal 8000 cubic feet dug out of a cellar?

20. At 20 cubic feet to a cart load, how many loads will there be in 10,000 cubic feet?

Written Problems

1. After selling 175 bushels of wheat a farmer still has 350 bushels remaining of this year's crop. What per cent of the crop did he sell?

2. After buying 120 acres of land a farmer has 600 acres. By what per cent did he increase the original size of the farm?

3. When a pupil has read 285 of the 300 pages in her book, (*a*) what per cent of the book has she read? (*b*) What per cent remains?

4. If oranges are bought at 25 cents a dozen and sold at the rate of 2 for 5 cents, what per cent is gained?

5. Stockings costing 25 cents per pair are sold at the rate of 3 pairs for a dollar. What per cent of the cost is the profit?

6. Dress goods costing 33⅓ cents a yard are damaged and sold at 25 cents a yard. What per cent of the cost is lost?

7. Apples bought at 3 for 2 cents are sold at 2 for 3 cents. Find the gain per cent.

8. A man sells a calf for $15.00 by which he gains $2.50. What per cent of the cost is the gain?

9. A man sold a pig for $15 by which he lost $2.50. What per cent of the cost was the loss?

10. A village had a population last year of 210. The population is now 252. What is the increase per cent?

11. Last year a village had a population of 252. The population this year is 210. What is the loss per cent?

12. Of a school of 150 pupils 144 are present. (*a*) What is the per cent of attendance? (*b*) What is the per cent of absence?

13. A bale of cotton bought at $9\frac{3}{8}$ ¢ per pound is sold for $10\frac{1}{4}$ ¢ per pound. What per cent is gained ?

14. (*a*) What is the profit on a bale of cotton weighing 400 pounds bought at $9\frac{3}{8}$ ¢ per pound and sold at $10\frac{1}{4}$ cents per pound? (*b*) What per cent is gained ?

15. When a grocer gains 4 % by selling sugar at $5\frac{1}{2}$ cents per pound, (*a*) what is the cost of the sugar per pound ? (*b*) What is his profit on a barrel containing 300 pounds ? (*c*) What is his percentage of profit on the sale of a barrel of sugar?

16. If a farmer raises 325 bushels of wheat this year on the same number of acres as produced only 250 bushels last year, what is the per cent of increase?

17. A builder sold a house for $2520, by which he made a profit of $420. (*a*) What % did he gain ? (*b*) What fraction of the selling price did he gain ?

18. A man sold a house for $2520 and by so doing lost $\frac{1}{5}$ of what it cost him. What did he pay for the house ? What fraction of the selling price is equal to his loss ?

19. A grocer sold a quantity of coffee for $3600, one-sixth of this amount being profit. What per-cent did he gain on the cost of the coffee ?

20. (*a*) What per cent does a boy make on 60 peaches bought at 3 for 2 cents and sold at 2 for 3 cents? (*b*) What per cent is made on an article bought at $\frac{3}{4}$ ¢ and sold for $\frac{3}{2}$ ¢ ? (*c*) On one bought at $\frac{4}{5}$ ¢ and sold for $\frac{2}{5}$ ¢. (*d*) On one bought at $4 and sold for $8 ?

21. (*a*) If a man's gain is $\frac{1}{5}$ of the cost of his goods, what fraction is it of the selling price ? (*b*) If a man's gain is 25 % of the selling price, what per cent is it of the cost ?

Comparing Numbers

Five ball players have made batting scores as follows :
    A has made 16 hits out of 45 times at bat.
    B has made 11 hits out of 30 times at bat.
    C has made 14 hits out of 40 times at bat.
    D has made 15 hits out of 42 times at bat.
    E has made 13 hits out of 36 times at bat.

These records might be expressed in the fractional form thus:

A, $\frac{16}{45}$; B, $\frac{11}{30}$; C, $\frac{7}{20}$; D, $\frac{5}{14}$; E, $\frac{13}{36}$.

For purposes of comparison, the decimal form is simpler:

A, .355$\frac{5}{9}$; B, .366$\frac{2}{3}$; C, .35; D, .357$\frac{1}{7}$; E, .361$\frac{1}{9}$.

In the employment of the decimal form in baseball averages, each is written as thousandths, fractions in the fourth place below $\frac{1}{2}$ being rejected. If the fraction is $\frac{1}{2}$ or higher, the decimal in the third place is increased by 1. The scores would then appear:

A, .356 ; B, .367 ; C, .350 ; D, .357 ; E, .361.

While the decimal point is always written in connection with these records, the word *thousandths* is generally omitted in speaking of them, the record of C being stated as three-fifty. If they are given as per cents, they should be written:

A, 35.6% ; B, 36.7% ; C, 35.0% ; D, 35.7% ; E, 36.1% ;

being read 35 and 6 tenths per cent, etc. C's record is 35%, but the cipher is printed for the sake of uniformity.

Written Problems

1. Find the records, in thousandths, of the following players :

PLAYERS	AT BAT	HITS		PLAYERS	AT BAT	HITS
M	60	22		N	90	34
O	75	27		P	66	24
Q	48	18		R	54	19

2. Carry out to tenths (*a*) the percentage of increase in the population of a village which had 450 inhabitants last year and now has 475. (*b*) The percentage of decrease if the population has fallen from 475 to 450.

3. Which city shows the greater percentage of increase; M, which grew in a year from 12,000 to 12,689; or N, which, during the same period, grew from 15,000 to 15,860? Give the rate of increase for each.

4. A merchant's sales were $150,000 in 1914, $190,000 in 1915, and $230,000 in 1916. What was the rate of increase (*a*) for 1915 over 1914? (*b*) For 1916 over 1915? (*c*) For 1916 over 1914?

5. A merchant's sales fell off from $230,000 to $190,000 one year, and from $190,000 to $150,000 the next year. What was the rate of decrease each year?

6. The receipts of grain in a certain city during a week were: wheat, 7250 bu.; corn, 7810 bu.; oats, 4315 bu.; rye, 6230 bu.; barley, 1475 bu.; buckwheat, 420 bu. What per cent of the total did each kind constitute?

	PROCESS	RATE	RATE	RATE
Wheat	7,250 bu. ÷ 27,500 =	26.36 %	26.4 %	26 %
Corn	7,810 bu. ÷ 27,500 =	28.4	28.4	28
Oats	4,315 bu. ÷ 27,500 =	15.69	15.7	16
Rye	6,230 bu. ÷ 27,500 =	22.65	22.6	23
Barley	1,475 bu. ÷ 27,500 =	5.37	5.4	5
Buckwheat	420 bu. ÷ 27,500 =	1.53	1.5	2
Total	27,500 bu. ÷ 27,500 =	100.00 %	100.0 %	100 %

Obtain the rate for each by dividing its quantity by the total. Carry it out in the first result to two decimal places. If the answer is required in *one* decimal place, increase the tenths' figure by 1 in three of the rates to make the total 100 when the hundredths' figures are rejected. Thus, change 26.36 to 26.4, 15.69 to 15.7, and 5.37 to 5.4, taking the three having the largest figure in hundredths' place. If the answer is required in whole numbers, increase the ones' place of three of the rates by 1, as in the last column.

7. Kentucky contains 40,000 square miles of land and 400 square miles of water; what is the per cent of each?

Interest

Preparatory Exercises

Frank Carroll has borrowed $2000 from Peter H. De Nyse. As evidence of the debt Mr. Carroll gives the latter his *promissory note* as follows:

Joliet, Ill., March 8, 1914

On demand I promise to pay to the order of

----------------*Peter H. De Nyse*----------------

Two Thousand $\frac{00}{100}$~~~~~~~~~~~~~~~~~~~~~~*Dollars*

Value received, with interest at 6%.

$ *2000* $\frac{00}{100}$ *Frank Carroll*

Sept. 8, 1914
Received interest sixty dollars.
P. H. De Nyse.

March 8, 1915
*Received interest sixty dollars.   Cash on %
four hundred dollars.*
P. H. De Nyse

The *indorsements* show two semi-annual payments of interest and a reduction of the debt by the payment of $400.

Sight Exercises

1. How much interest is payable on the new principal Sept. 8, 1915?

2. Give interest as follows:

	PRINCIPAL	RATE	TIME		PRINCIPAL	RATE	TIME
a.	$200	8%	¼ yr.	*b.*	$100	5%	6 mo.
c.	300	6%	⅓ yr.	*d.*	400	8%	4 mo.
e.	600	7%	½ yr.	*f.*	500	6%	3 mo.

Written Exercises

1. Mr. Rodman borrowed $350 at 6%. How much interest is due in 84 days?

PROCESS

$$\frac{\overset{.01}{\$3\cancel{50}} \times \overset{14}{\cancel{.06}} \times \overset{}{\cancel{84}}}{\underset{\cancel{6}}{\cancel{360}}} = \$4.90 \quad Ans.$$

Write 6% as .06 and 84 da. as $\frac{84}{360}$ (yr.). Cancel.

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2. Find interest as follows:

PRINCIPAL	RATE	TIME		PRINCIPAL	RATE	TIME
a. $100,	8%,	90 da.	*b.*	$600,	6½%,	120 da.
c. $200,	6%,	45 da.	*d.*	$700,	6%,	230 da.
e. $300,	5%,	80 da.	*f.*	$800,	4½%,	125 da.
g. $400,	4%,	65 da.	*h.*	$720,	7%,	136 da.
i. $500,	9%,	72 da.	*j.*	$360,	5½%,	240 da.

3. How much interest is due Aug. 11, 1915, on a note for $187.20 dated Dec. 23, 1914?

PROCESS

$$Int. = \frac{\overset{23.40}{\$1\cancel{87.20}} \times \overset{.005}{\cancel{.075}} \times \overset{77}{\cancel{231}}}{\underset{\underset{\cancel{8}}{\cancel{120}}}{\cancel{360}}} = \$9.009. \quad Ans. \; \$9.01.$$

Find the time in days by adding to the 8 remaining days in December, 31 for January, 28 for February, etc., and 11 days for August; in all 231 days.

4. Find the amount required to settle each of the following notes with interest.

FACE	DATED	PAID	RATE
a. $120;	Jan. 16, 1914;	Dec. 6, 1914;	8%.
b. $240;	Feb. 10, 1916;	Oct. 4, 1916;	6%.
c. $180;	Mar. 18, 1915;	May 5, 1915;	7%.
d. $360;	Apr. 10, 1914;	Jan. 9, 1915;	9%.
e. $540;	May 5, 1915;	Feb. 29, 1916;	6%.

5. How much interest is due May 5, 1915, on a note for $358.60 dated July 17, 1913?

When the time is over a year, obtain it by compound subtraction, deducting the year, the month, and the day of the earlier date from the corresponding items of the later one.

$$\begin{array}{r} 1915 - 5 - 5 \\ 1913 - 7 - 17 \\ \hline 1 - 9 - 18 \end{array}$$

Find the number of days by adding 360 days (for the year), 270 (for the 9 months) and 18; 648 days.

PROCESS

$$\frac{\$\,358.60 \times \cancel{.06}^{.01} \times \cancel{648}^{10.8}}{\cancel{360}_{\cancel{60}}} = \$\,38.7288. \quad \textit{Ans.} \ \$\,38.73.$$

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6. Find the interest on the following:

a. $270 from Jan. 16, 1915 to Dec. 6, 1916 at 6%.

b. $330 from Feb. 10, 1914 to Oct. 3, 1915 at 4½%.

c. $450 from Mar. 18, 1915 to May 5, 1916 at 5%.

d. $180 from Apr. 12, 1913 to Dec. 4, 1915 at 7½%.

e. $510 from May 25, 1915 to July 9, 1916 at 9%.

f. $240 from Aug. 15, 1914 to Oct. 2, 1915 at 4%.

g. $720 from Nov. 12, 1916 to Dec. 9, 1917 at 5%.

Bank Loans and Discount

. A customer of a bank who obtains a loan gives a *note*
for the sum borrowed. This may be an interest-bearing
note, in which case the borrower pays the face of the note
with the interest at the specified time.

In the cases of a note not bearing interest the bank
collects the interest in advance by deducting it from the
face of the note, giving the borrower the balance.

Sight Exercises

1. The following is a note given in settlement of an
account :

Davenport, Iowa, Jan. 27, 1915

Ninety days after date I promise to pay to the order

of .... Thomas Currivan ....

Six Hundred $\frac{00}{100}$ ∼∼∼∼∼∼∼∼∼∼∼∼∼∼∼∼∼*Dollars*

Value received, at the Mechanics' Bank.

$ 600 $\frac{00}{100}$ *William Kassenbroek*

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2. On what day is this note due ?

Bank Discount

If Mr. Currivan desires to obtain cash for the foregoing
. note, he can have it *discounted* at the Mechanics' Bank.
If he does this on Jan. 27, 1915, the bank deducts 90 days'
interest, which at 6 % is $9, and gives him the balance,
$591. This $9 interest, paid in advance, is called the
bank discount; the remaining sums, $591, is called the
proceeds or the *avails.*

Maturity of a Note

As a rule, a one-month note dated March 1 is due April 1; while a 30-day note of the same date is due March 31.   When the specified number of days makes a note payable on a Sunday or a holiday, the next business day is taken as the date of maturity, and the new date is considered in calculating the discount.

Days of Grace. — Formerly the date of maturity was taken as 3 days after the time fixed by the terms of the note.   These days, called *days of grace*, have been abolished in nearly all of the states.   Pupils should ascertain the practice in their respective localities, and determine the discount by the prevalent method.   .

Sight Exercises

1. Find the bank discount (interest), at 6 %, on notes, as follows :

	Face	Term			Face	Term
(a)	$600	60 da.		(b)	$500	120 da.
(c)	$400	· 30 da.		(d)	$900	90 da.
(e)	$100	90 da.		(f)	$300	60 da.

2. Find the proceeds of the following notes discounted at 6 % :

	Face	Term			Face	Term
(a)	$100	30 da.		(b)	$800	45 da.
(c)	$500	90 da.		(d)	$400	60 da.
(e)	$900	60 da.		(f)	$200	90 da.

3. Find the date when the following notes are due :

	Date	Time			Date	Time
(a)	Jan. 26	30 da.		(b)	Nov. 4	63 da.
(c)	March 14	60 da.		(d)	Feb. 11	28 da.
(e)	May 25	90 da.		(f)	April 9	30 da.
(g)	July 16	21 da.		(h)	June 25	15 da.

Review

Sight Problems

1. Find the cost of 864 yards of ribbon at 12¼ cents per yard.

2. How much must be paid for 4 dozen hammers at $1.12½ each?

3. A dealer bought 176 yards of toweling at 6¼ cents per yard. What was the amount of his bill?

4. At 6 pairs for $1, how many pairs of stockings can be bought for $4.50?

5. Find the width of a field containing 7000 square rods when its length is 87½ rods.

6. If a man's purchases amount to $15.29, how much change should he receive out of a $20 bill?

7. What is the total cost of a cloak at $8.75 and a pair of shoes at $3.50?

8. When dress goods are sold at 37½ cents per yard, what quantity can be bought (*a*) for $6? (*b*) For $1?

9. (*a*) At $¾ per yard, what quantity of silk can be bought for $1? (*b*) At $⅖ per pound, what quantity of tea can be bought for $4? (*c*) For $1?

10. If a girl can do ¾ of a piece of work in a day, how long would it require her to do the whole work?

11. What is the quotient (*a*) of 5 fifths divided by 4 fifths? (*b*) Of 1 ÷ ⅕?

12. The length of a field is 84 yards; the width is 3 fourths of the length. Find the width.

13. What is the area of a right triangle 84 rods long, 75 rods wide?

Standard Weights

1 bushel of wheat   = 60 lb.   1 bushel of oats = 32 lb.
1 bushel of barley   = 48 lb.   1 bushel of corn = 56 lb.
1 bushel of potatoes = 60 lb.   1 barrel of flour = 196 lb.
The foregoing are the legal weights in many states.

Sight Exercises

In the following examples use the weight legalized by your own state.

1. Give the weight of each :

a. 150 bu. wheat.   *b.* 75 bu. barley.   *c.* $1\frac{1}{8}$ bu. corn.
d. 200 bu. oats.   *e.* 1 pk. potatoes.   *f.* $1\frac{1}{2}$ bbl. flour.

2. What part of a bushel is

a. 30 lb. wheat?   *b.* 36 lb. barley?   *c.* 45 lb. potatoes?
d. 15 lb. potatoes?   *e.* 49 lb. corn?   *f.* 24 lb. oats?

Written Exercises

1. Find the cost of each.   Use cancellation.

a. 3948 lb. wheat @ $1 per bushel.
b. 4666 lb. oats @ 40 ¢ per bushel.
c. 8793 lb. barley @ 48 ¢ per bushel.
d. 87346 lb. flour @ $5.60 per barrel.
e. 38975 lb. potatoes @ 48 ¢ per bushel.
f. 94206 lb. corn @ 60 ¢ per bushel.

2. How many tons of 2000 lb. each are there in a carload of corn containing 4000 bushels ?

3. How many bushels of oats weigh a ton of 2000 lb. ?

4. If an acre of land yields $87\frac{1}{2}$ bushels of potatoes, what is the weight of the potatoes raised on 64 acres ?

5. If a 40-acre field averages 2750 pounds of hay to the acre, what is the yield in tons of 2000 lb. ?

Sight Review Problems

1. How many years and months from Jan. 1, 1915, to April 1, 1917 ?

2. When a man is hired for 3 months from Feb. 1, on what date does his service end ?

3. If a watch loses 10 seconds per day, how many minutes does it lose from noon of Aug. 1 to noon of Aug. 19 ?

4. In a year of 200 school days, Mary was absent 2 days. (*a*) What fraction of the time was she absent? (*b*) What decimal ? John was absent 4 days. (*c*) What fraction of the time was he absent ? (*d*) What decimal ?

5. A baseball club played 20 games. It lost 4 games. What fraction of the games did it win ? What decimal ? How many hundredths ?

6. If a boat uses 3 tons of coal in 24 hours, (*a*) what part of a ton is used in an hour ? (*b*) How many pounds ?

7. How long would a 51-gallon barrel of oil last if 3 quarts are used per day ?

8. What fraction of a square foot is there in a pane of glass 10 inches long, 6 inches wide? If a box of glass contains 50 square feet, how many such panes are there in the box?

9. A rectangular piece of land is 40 rods long and 12 rods wide ; how many acres does it contain?

10. (*a*) How many cubic feet in a cube 3 ft. long ? (*b*) How many cubic feet in a cubic yard ?

11. At $\frac{4}{5}$ bushel to the cubic foot, how many bushels will a bin hold when it measures 5 ft. by 5 ft. by 5 ft. ?

12. (*a*) Give three factors of 231. (*b*) What are the interior dimensions of a box whose capacity is 231 cu. in.?

13. At 25 cents per dozen what will the owner of 100 hens receive for their eggs when each lays, on an average, 150 eggs?

14. February 1, 1916, falls on Tuesday; what day of the week is February 29th?

15. What is the date of the first Tuesday in March, 1916?

16. Give the areas of rectangular fields having dimensions as follows:

a. 168 rd. × 25 rd.   *d.* 72 in. × $37\frac{1}{2}$ in.
b. 125 yd. × 64 yd.   *e.* 48 mi. × $87\frac{1}{4}$ mi.
c. 160 ft. × 75 ft.   *f.* 88 yd. × $62\frac{1}{2}$ yd.

17. Give the areas of right triangles having dimensions as follows:

a. 48 rd. × $87\frac{1}{2}$ rd.   *d.* 72 mi. × 75 mi.
b. 96 yd. × $16\frac{2}{3}$ yd.   *e.* 88 in. × 50 in.
c. 84 ft. × $33\frac{1}{3}$ ft.   *f.* 24 rd. × 25 rd.

18. What is the price per pound of the lean meat in a rib roast costing 20 cents per pound when 50% of it is waste?

19. A room is 21 feet long, 15 feet wide, and 9 feet high. How many square yards are there in the ceiling? How many square yards of carpet are required to cover the floor? How many square yards are in each side wall? How many square yards are in each end wall?

20. What is the total weight of 32 hams averaging $12\frac{1}{2}$ pounds each?

21. How many bushels of wheat are raised on 84 acres at the rate of 25 bushels per acre?

22. How many cubic feet will a wagon body hold when it is 10 feet long, 3 feet wide, and 27 inches deep?

Written Problems

1. A planter sold his crop of 300 bales of cotton, averaging 480 lb. each, at 12½¢ per pound. How many $1000 bills would pay for the crop? (Cancel.)

2. Find the cost of 864 bags of coffee of 130 lb. each at 6¼ cents per pound. (Cancel.)

3. A produce dealer bought 487 bbl. pork @ $19.75 per barrel. Find the cost of the pork. (Employ a short method.)

4. When oats are 37½¢ per bushel, how many bushels can be bought for $396? (Cancel.)

5. A man pays $4285 for a shipment of corn at 62½¢ per bushel. How many bushels does he receive? (Cancel.)

6. Find the weight of 176 cattle averaging 875 lb. each. (Cancel.)

7. When wheat is selling at 99⅞¢ per bushel, (*a*) what will be the cost of 1296 bu.? (*b*) How much less than $1296 will be the cost?

8. At $3.75 per yard find the price of 49 yards of velvet.

9. Find the area of a rectangle 64 rods long, 49⅞ rods wide.

10. Multiply 147 (*a*) by 99. (*b*) By 999. (*c*) By 99¾. (*d*) By 99⅝. (*e*) By 99⅞.

11. Divide 1462 (*a*) by 25. (*b*) By 125. (*c*) By 33⅓. (*d*) By 16⅔. (Give quotients in mixed decimals.)

12. What is the quotient of 147 (*a*) by .25? (*b*) By .125? (*c*) By 16⅔%? (*d*) By 33⅓%?

13. At 16⅔¢ per pair, how many dozen pairs of cuffs will cost $27?

14. At $12\frac{1}{2}$ ¢ each how many dozen collars will cost $25?

In the following examples first indicate the operations, then shorten the work by cancellation.

15. If $2\frac{1}{2}$ acres of land cost $183.60, what is the cost of $1\frac{7}{8}$ acres, at the same rate?

PROCESS

When $2\frac{1}{2}$ acres cost $183.60
1 acre costs $183.60 ÷ $2\frac{1}{2}$
and $1\frac{7}{8}$ acres cost ($183.60 ÷ $2\frac{1}{2}$) × $1\frac{7}{8}$

$$\frac{\overset{45.90}{\cancel{\$183.60}} \times \cancel{2} \times \overset{3}{\cancel{15}}}{\underset{4}{\cancel{5} \times \cancel{8}}} = \$137.70. \quad Ans.$$

Reduce the divisor $2\frac{1}{2}$ to an improper fraction, invert it and write it at once in its place, 2 above the line and 5 below. Change the multiplier $1\frac{7}{8}$ at once to an improper fraction, and write it as shown above.

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16. If $\frac{2}{5}$ of a man's money is $840, what is $\frac{7}{8}$ of it?

$$\$840 \times \tfrac{5}{2} \times \tfrac{7}{8}$$

17. At the rate of $1.64 for 2 lb. 9 oz. of pepper, what is the cost of 1 lb. 7 oz. ?

Change both weights to ounces.

18. If a man can do $\frac{3}{4}$ of a piece of work in $4\frac{1}{2}$ days, what part of it can he do in $3\frac{3}{4}$ days?

19. How many tons of coal will be consumed in 100 days if 100 lb. are used in $7\frac{1}{2}$ hours ?

20. A picture 18 inches long and $10\frac{1}{2}$ inches wide is reduced by photography to one $7\frac{1}{2}$ inches long. What is the width?

21. If a tablecloth 10 ft. square costs $5, what should be the cost of one 12 ft. square, at the same rate?

22. If a man receives $12.60 as interest on his money for 5 years, what interest should he receive in 7 yr. 9 mo.?

23. When 24 men dig a ditch 120 yd. long in 6 weeks, how many men will be required to dig a ditch 180 yd. long in 3 weeks?

PROCESS

To dig 120 yd. in 6 wk. requires . . . . 24 men

" " 1 " " 6 " " . . . . . $\dfrac{24 \text{ men}}{120}$

" " 1 " " 1 " " . . . . $\dfrac{24 \text{ men} \times 6}{120}$

" " 180 " " 1 " " . . . . $\dfrac{24 \text{ men} \times 6 \times 180}{120}$

" " 180 " " 3 " " . . . . $\dfrac{24 \text{ men} \times 6 \times 180}{120 \times 3}$

The number of men being required, write 24 men last.

To dig a ditch 1 yd. long would require $\frac{1}{120}$ of the number of men; therefore, make 120 a divisor.

To do it in 1 week would require 6 times the number of men; make 6, therefore, a multiplier.

To dig a ditch 180 yd. long requires 180 times as many men; make 180, therefore, a multiplier.

To do it in 3 weeks requires $\frac{1}{3}$ the number of men; make 3, therefore, a divisor.

Cancel. Find answer.

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24. If it costs $30.60 for feed for 9 horses for 17 weeks, what will be the cost of the feed required for 27 horses for 11 weeks?

25. What is the cost of digging a cellar 12 yd. long, 9 yd. wide, and 4 yd. deep, at the rate of $120 for digging one 40 ft. long, 30 ft. wide, 9 ft. deep?

26. What is the cost of carpeting a room that is 18.5 feet long and 14 feet wide, with carpet costing $1.25 a square yard?

27. What time has elapsed from the discovery of America Oct. 14, 1492, to July 4, 1776?

28. A man worked 153 days (excluding 22 Sundays) from July 5. What was the date of the last working day?

29. If a watch loses 10 seconds per day, how much time does it lose from 9 A.M. Aug. 1 to 3 P.M. Aug. 15?

30. A vessel uses 27 tons of coal in a day; how many pounds are used in an hour?

31. How long would a 51-gallon barrel of oil last if 8 quarts 1 pint are used per day?

32. A drover invested $950 in sheep at $3.80 per head. If 5% of them die, how much must he receive a head for the others in order that he may neither gain nor lose?

33. The owner of a farm of 640 acres sold $37\frac{1}{2}$% of it for $10,800. What did he obtain per acre for the part sold?

34. At 160 square rods to the acre, find the number of acres and the decimal of an acre in a field 40 rods long, 30 rods wide. What fraction of a mile of fence is required to inclose it?

35. A train travels 351 miles from 9.30 A.M. to 7.15 P.M. What is the average rate per hour?
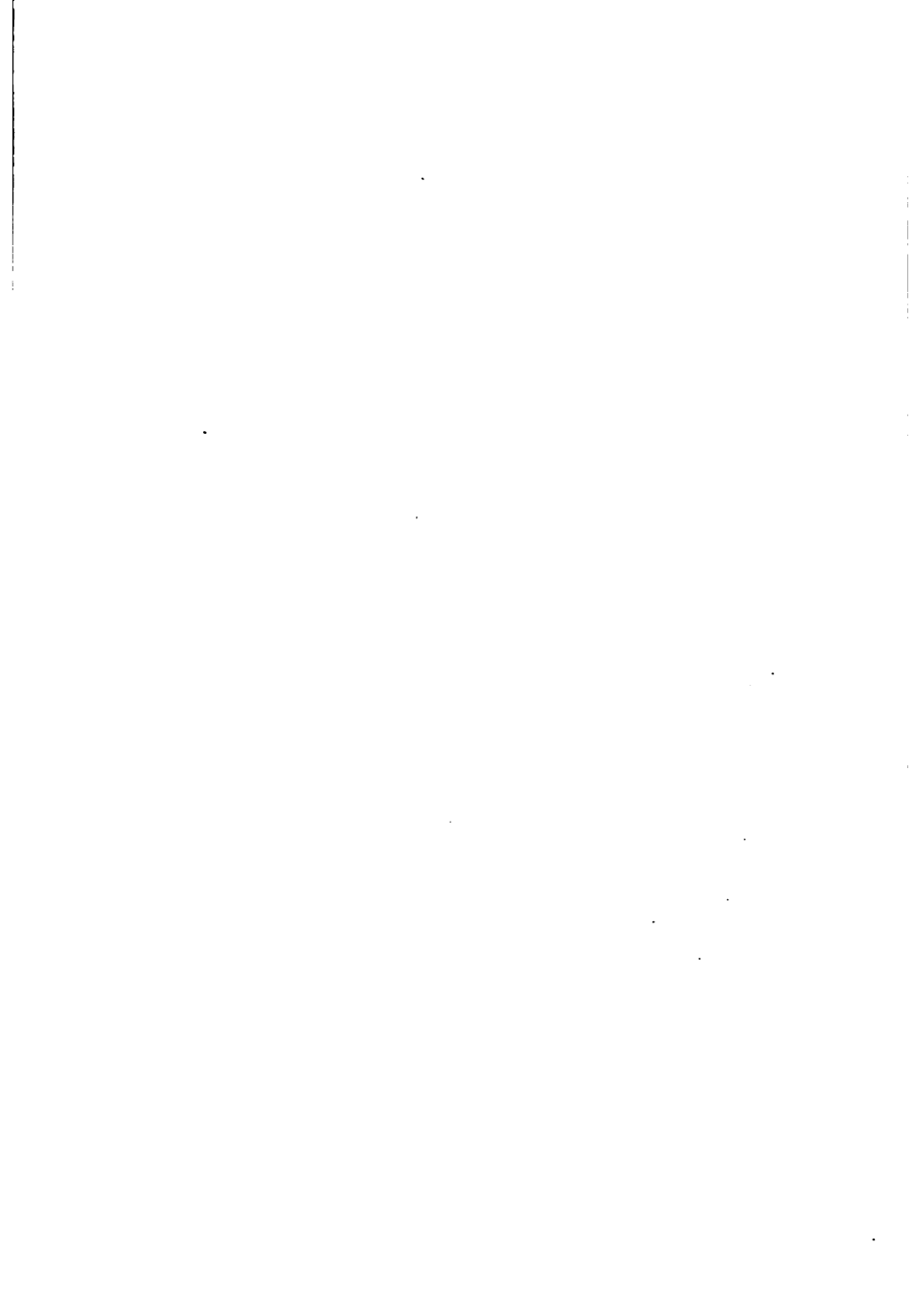
36. A man pays 8 mills tax on each dollar his farm is valued. What does he pay on a farm valued at $5500?

37. A merchant spent 20% of $1650 for coffee at $12\frac{1}{2}$¢ per pound. (*a*) How many pounds did he buy? How many pounds of tea at 30¢ per pound could he obtain for the remainder?
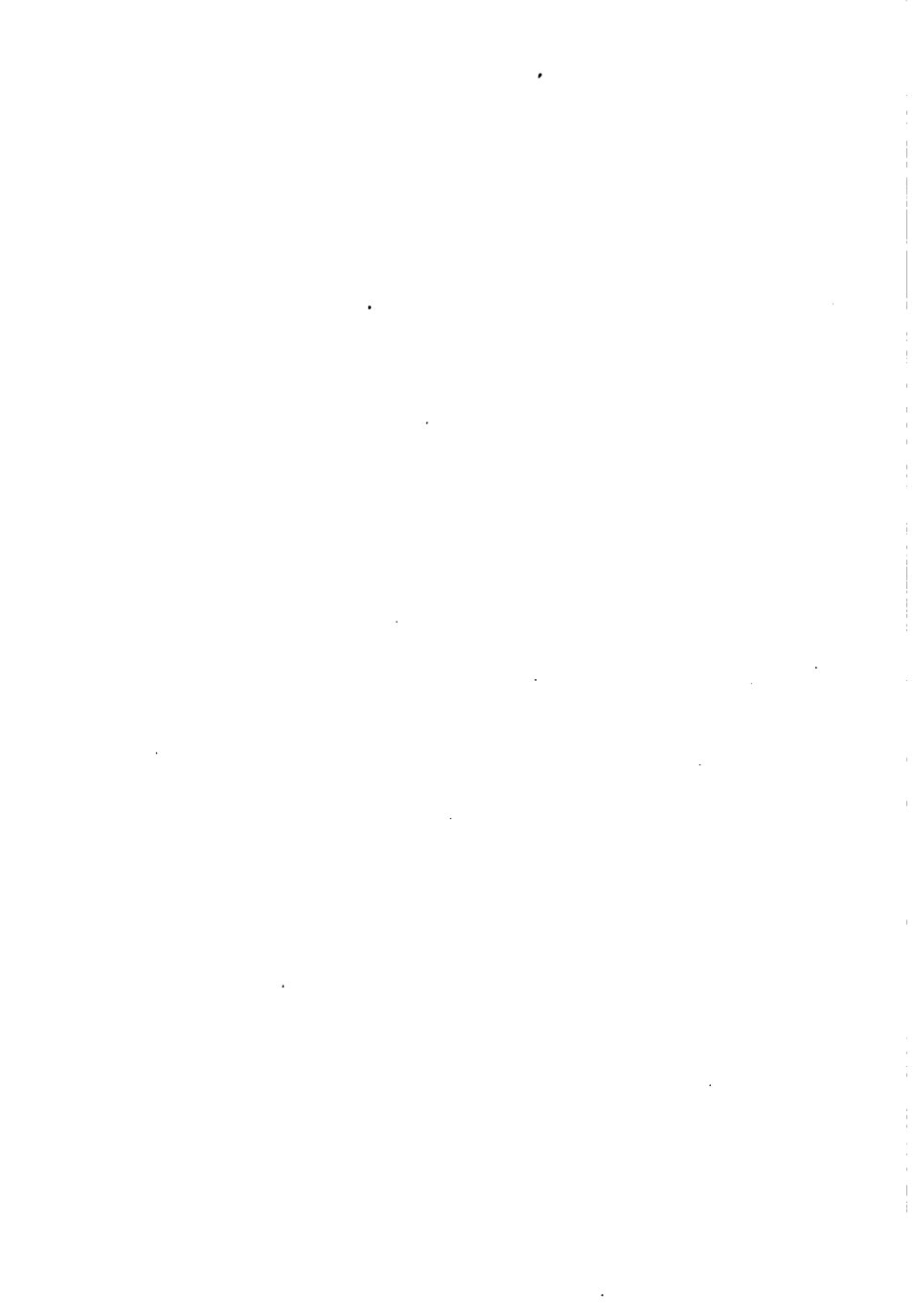
38. What is the value in United States money of an article costing 25 francs, a franc being worth 19.3 cents?

39. A grocer bought 253 pounds of coffee for $42.50 and sold it at 20¢ a pound. What was his gain?

40. (*a*) How many square rods are in a rectangular field 36.8 rods long, 20 rods wide? (*b*) How many rods of fence are required to inclose it?